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AUTHOR Mistichelli, Judith; Roysdon, Christine  
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## ABSTRACT

Intended primarily for the researcher, teacher, or student new to the interdisciplinary study of the impact of technology on man and his habitat, this annotated bibliography is designed to provide a guide to significant statements on technology from humanistic points of view. Works have been chosen which integrate technology with man's social, aesthetic, and ethical experience, and many deal with man as a builder and the values which enter into his creations. The more than 100 citations are listed in 11 categories: overviews, anthologies, historical studies, art, architecture and urban design, literature and critical studies, fiction and poetry, social impact and technology assessment, philosophy and ethics, case studies, and journals. (RAO)

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## Beyond Technics Humanistic Interactions with Technology

a basic collection guide

Humanities Perspectives  
on Technology Program

Lehigh University

1978

by Judith Mistichelli  
and Christine Roysdon

Lehigh University  
Libraries

The nasal whine of power whips a new universe. . .  
 Where spouting pillars spoor the evening sky,  
 Under the looming stacks of the gigantic powerhouse  
 Stars prick the eyes with sharp ammoniac proverbs.  
 New verities, new inklings in the velvet hummed  
 Of dynamos, where hearing's leash is strummed. . .  
 Power's script,--wound, bobbin-bound, refined--  
 Is stropped to the slab of belts on booming spools,  
     spurred  
 Into the bulging bouillon, harnessed jelly of the stars.  
 Towards what?

Hart Crane  
 "Cape Matteras." The Bridge.

The growing interest in research and course development concerned with technology's effect on civilization and with human values in an age of advancing technology indicates the necessity for a concise overview of literature in the field. We have endeavored here to provide a guide to the most significant statements resulting from considerations of technology from humanistic points of view. Works have been subjectively chosen which integrate technology with mankind's social, cultural, aesthetic, and ethical experience. Many of the studies deal with man as builder--as an engineer, artist, and designer of social communities--and with the values which help to formulate his creations.

Examination of the impact of technology on man and his habitat requires a wide-ranging perspective. Designed primarily for the researcher, teacher, or student new to the field, this annotated bibliography attempts to provide a basis both for an understanding of treatments of the issues to date and for investigation of the relevant scholarship in various disciplines. Certain volumes included are now approaching "classic" status. Others have been selected for the presence of a significant and eloquent statement of values, novelty of perspective, unique subject coverage, or substantial influence on succeeding studies.

We hope this guide will be of assistance in various endeavors: as a foundation for courses, as a tool for library acquisitions, as a catalyst for independent research, and, perhaps, as a stimulus for cross-disciplinary seminars and workshops. Most of all, our aim is to give initial guidance to those who may "get hooked" and someday accomplish the art of synthesis.

Cover design by Douglas Roysdon

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## 1. OVERVIEWS

Benthall, Jonathan. The Body Electric: Patterns of Western Industrial Culture. London: Thames and Hudson, 1976.

With a title borrowed from Whitman, Benthall offers a "framework for understanding the interactions between Western technology and Western civilization." A consideration of literature, art, and architecture clarifies the contradictory nature of man's response to technology. While he romanticizes his technical capacity because it provides the power to create his own future, his body constantly reminds him of perceptions and feelings that are alien to the objectivity, rationality and mechanism necessary to technology. Wells and Verne present a "romance of technology" which combines the terrifying potential of the machine with a negation of the body. This attitude is extended, Benthall states, by the futurist painters who, early in the 20th century, declared that man's sufferings were of the same interest as those of an electric lamp. In opposition is the "recoil to the body" exemplified by Blake, Rimbaud, Yeats, and Lawrence, as well as dance and avant-garde theatre. By an awareness of these attitudes, plus an understanding of the "neutral" positions of Marx and Rousseau, the author believes man can perhaps become aware of a "liberating technology." Such a view is evidenced in Saul Bellow's Augie March, the architecture of Frank Lloyd Wright, Whitman's poetry, and the cult of the motorbike. Only by learning as much as possible about technology's "mind-forged manacles," can the resourcefulness of the body cast them off.

Kuhns, William. The Post-Industrial Prophets. New York: Weybright and Talley, Inc., 1971.

A discussion, critique and comparison of contributors to "three traditions of contemporary thought on the machine." The first "tradition" Kuhns defines is that of Mumford, Ellul and Giedion, who have explored the thrust and power of technology on many aspects of human existence. A second tradition is identified in the work of Innis and McLuhan, with their theory that a new medium tends to rechannel the flow of ideas and the distribution of power. As a third group, he isolates the "optimists"--Buckminster Fuller and other designers bent on using technology to reshape the world. In conclusion, the author maps a common philosophical ground. The most important of the discovered postulates seem to be: the sense that the modern world is radically "new"; that ubiquitous data-gathering methods are legitimate and necessary for the study of

modern cultural history; that history is now anonymous; that technology is not neutral and that its effects are subtle and ambivalent.

Snow, C. P. The Two Cultures: and a Second Look. 1959. Cambridge: Cambridge University Press, 1964.

In his 1959 lecture, Snow voices the unwillingness and inability to communicate between literary intellectuals and scientists. Although bridges have been built between artists and both pure and applied scientists since Snow's remarks, the message presented here, with eloquence and definite charm, unquestionably served as a major catalyst to the programs of the last two decades which have broken through the barriers of "mutual incomprehension." One particularly strong indication of the polarization, as expressed by Snow, is that while scientists naturally have the "future in their bones," the more traditional artist-intellectual culture "responds by wishing the future did not exist." In isolation, technologists and scientists become immured in what is predictable while artists remain unaware of the forces controlling and changing the world. Snow notes that the only writer who seemed to have an understanding of the industrial revolution was Ibsen in his old age. The meeting of the two cultures, even if it is a clash, would spark imaginations and creative chances. For Snow the answer is a more interdisciplinary education for "neither the scientific system of mental development, nor the traditional, is adequate for our potentialities" or "for the world in which we ought to begin to live." The creative as well as social values of such collaborative programs have been proven, especially in the U. S., in recent years.

Spengler, Oswald. Man and Technics: a Contribution to a Philosophy of Life. 1932. Westport, Conn.: Greenwood Press, 1976.

Spengler's small book remains surprisingly relevant today. Technics is defined as the "tactics of living... not the implements but what one does with them...it is a matter of purposive activity never of things." Inventions spring from a delight in victory and as such are expressions of personality not utilitarian thinking. Because civilization now does everything in mechanical fashion, the multiplication and refinement of machines are contradicting even economic practice. Men wearied by unemployment and meaningless work mutiny in the form of strikes and suicides. Man's fascination with technical experiments has turned to a desire for sport. Spengler concludes that the machine-technics civilization will end in fragments, but when faced with the choice of Achilles, "better a short life, full of deeds and glory, than a long life without content."

## 2. ANTHOLOGIES

Bereano, Philip L., ed. Technology as a Social and Political Phenomenon. New York: Wiley, 1976.

Several years of developing a course at Cornell on the social implications of technological change have influenced the selection and organization of this anthology. Essays focusing on general or theoretical concepts have been chosen over a grab bag of undigested case studies. Lengthy introductory essays to the work of the authors included in each section further integrate the collection into a coherent whole. Selections are short and, on the whole, well-chosen. Some are introductions to books (Marcuse's One Dimensional Man, Bookchin's Post Scarcity Anarchism, e.g.); others are widely reprinted essays (e.g., McDermott's "Technology, the Opiate of the Intellectuals"). Social science prose pieces are interspersed with wake-up selections like Barry Lopez "In Praise of the Circle," and the incisive commentaries of Science for the People. Bereano describes the anthology's divisions as "clusters of materials emphasizing a theme;" themes include "the nature of technology," "technology and social change," and so forth. Among currently available anthologies, this collection, with its balanced view of technology and sound organization, is well suited to the no-nonsense undergraduate of the 70's.

Bernard, Harvey Russell, and Pertti J. Pelto, eds. Technology and Social Change. New York: Macmillan, 1972.

The case studies presented here compare the impact of two different kinds of technological developments on cultural change in developing countries and small-scale societies. Among the "macrotechnological developments" discussed are the Karibu Dam on the Zambezi River and the Ciudad Industrial superposed on rural Mexico. Such large-scale, planned changes require major social structural adaptations. Social consequences of major developments are often predicted, if not carefully or judiciously prepared for. A second category of change, termed here "microtechnological development" receives no equivalent assessment for potential detrimental consequences. Microtechnological changes encompass the introduction of new material goods - tools, vehicles, housing - through commercial sources. One study records the massive impact of the snowmobile on the social and economic structures of Arctic peoples; another measures changes induced by a whole range of consumer goods - radios, bicycles, lighting devices, etc. on the villages of rural Buganda. The conclusion is that microtechnological change does not necessarily imply corresponding microsocial change, and should be assessed accordingly.

Burke, John G., ed. The New Technology and Human Values.  
Belmont, Calif.: Wadsworth Pub. Co., 1966.

With the term "new technology," Burke refers to those recent technological developments that stem from the "interaction between basic sciences and applied sciences." To provide an historical perspective, the opening section offers an odd literary array commencing with a period indictment of the Luddites and closing with an indictment of "scientific superstition" by Leo Tolstoy. Papers in the subsequent sections on science and human values treat not only those values that science may have imposed on society, but also the value-laden (superstitious?) quality of science itself. The second part of the volume is devoted to the social, leisure and philosophical problems posed by automation. Contributions to the third part consider what were ten years ago emerging issues: the environment, the preservation of privacy, bioethics. Closing papers delve into the pragmatics of science and government policy-making and projections for the social control of science. Some of the material in this anthology is dating badly. The excerpt from JFK's White House Message on Education and the MIT 1964 Commencement Address, to name two examples, are already archaic in tone for the reader of 1977. But the anthology's continuing value lies in the diverse sources, viewpoints and prose forms represented.

Douglas, Jack D., ed. Freedom and Tyranny: Social Problems in a Technological Society. New York: Knopf, 1970.

Hardly intended to be an unbiased, impartial selection, Jack Douglas' anthology has been organized to explore the theme of technological "tyranny." In the introduction, he writes, "the technological society thrives on centralization, massive size and expert decision making - all of which have served to undermine the foundations of our traditional freedoms and their direct threats to those freedoms appear to be growing at an accelerating rate." The initial section, ominously titled "The Secret Tyranny in Technological Society," features exposes by Marcuse and Ellul. "Pseudo-events," discovered by Boorstin, are among the forms that have evolved into the "tyranny of propaganda" described in the next chapter. Other tyrannies that Douglas and his contributors perceive are the autocratic control of information and power by technologists, and perhaps worst, the "tyranny of experts," most insidious among whom are "social engineers" in industry and community. What's to relieve us of all this oppression? The concluding authors unreservedly embrace centralized social and technological planning as a panacea and indeed a requirement for our collective survival into the future.

Kranzberg, Melvin and William Davenport, eds. Technology and Culture: an Anthology. New York: Schecken Books, 1972.

An indispensable collection of important articles by major historians and litterati, treating the interplay of technology and culture from a number of viewpoints. Authors represented include Heilbroner, Drucker, Mumford, White, to name a few. The anthology contains theoretical essays and excerpts from books, illustrative case studies (e.g., on the Dead Sea Scrolls and the Watt-Boulton steam engine) and biographical profiles (Henry Ford, Louis Sullivan among them). Organized to attack major questions (to what extent technology is deterministic and/or autonomous, e.g.), it also illuminates such broad areas as the politics of technology and the complexity of the innovative process. The editors have also made a significant contribution in writing the introduction, a thoughtful overview of major problem areas and of the work of the authors anthologized.

### 3. HISTORICAL STUDIES

Boorstin, Daniel. The Americans: The Democratic Experience. New York: Random House, 1973.

The final volume of Boorstin's trilogy of American history concerns the democratization of things as well as our reactions to them. Beginning in the mid-nineteenth century and extending to the present, the direction of change produced by new products of technology and science has been toward standardization and homogenization. Boorstin looks at specifics: ready-made clothes, credit cards, department stores, family dinners at McDonald's. The social effect of technology has been a leveling of time and place, e.g. the development of condensed milk made the product portable and less associated with particular times or places, the increased use of glass in buildings transformed the intimacies of personal life, and new photographic techniques changed our attitude toward the distant. The result has been an attenuation of experience to something less vital. Boorstin asks:

Did the very perfection of techniques for widening experience, and especially those for creating and diffusing the repeatable experience--did all this, somehow, impoverish experience in the very process of democratizing it? Was it inevitable that a democratized experience, however rich and technologically sophisticated, should be impoverished?

Giedion, Sigfried. Mechanization Takes Command: A Contribution to Anonymous History. New York: Oxford University Press, 1948.

Giedion's intent is to "observe the coming of mechanization from the human standpoint" through the technique of "anonymous history" -- the tracing of mechanization through some of the humbler things of the era. The Swiss historian's exhaustive data-gathering process led him to plants, farms and American patent records. The first section uses the development of the doorlock to demonstrate the transformation of a highly complex and specialized craft into a mechanized production process. The most original section may be that devoted to "means of mechanization": the assembly line and scientific management. Indicative of Giedion's basically antipathetic attitude toward technology is "Mechanization Encounters the Organic"--a grisly chapter on the debasement of our daily bread and the anonymous murder of our daily meat. How mechanization touched human surroundings is revealed through changing

concepts of comfort (and its reflection in furniture design), as well as the transformation of kitchen and bath by the efficiency expert. Lavishly documented and illustrated.

Kasson, John F. Civilizing the Machine: Technology and Republican Values. New York: Grossman Pub., 1976.

Colonial Americans initially feared that the introduction of manufactures would necessarily mean the import of the social evils of the industrial revolution in England. Agrarianism was equated with Republican virtues--personal liberty, public virtue, dispersed power. In a study related to that of Leo Marx, Kasson skillfully traces how, during the nineteenth century, technology became vital and inseparable from republicanism. The exigencies of the Revolution started the process. Moving to major developments, Kasson reviews the early "model" Lowell, Massachusetts factory "utopia." He suggests that while the young women who worked there and wrote paeans to industry were not a debased proletariat, they were powerless to demand improvements in wages or conditions. As a representative writer of ambivalent mind toward technology, Kasson profiles Emerson. The poet enjoyed the new sense experiences offered by machines (train whistles, flashing scenery), but feared that technological growth would prove burdensome to the free imagination. Aesthetically, Kasson shows, Americans delighted in their machines--decorated them, exhibited them; contemporary magazines portrayed their operation as an awesome artistic spectacle. The closing section examines turn-of-the-century utopias of Bellamy, Twain and Donnelly, and their varying lack of hope for a civilized machine.

Kranzberg, Melvin and Carroll W. Pursell, eds. Technology in Western Civilization. New York: Oxford University Press, 1967. 2 vols.

This lengthy, compressed and heavily illustrated two volume anthology originated as part of a project in curriculum development for the Armed Forces. The first volume covers the emergence of industrial society from earliest times to 1900. It is divided by chronological period, each division containing articles treating not only technological advances, but also the socio-cultural impact of those advances. Studies range from discussions of the classical attitude toward labor-saving devices to the social effects of the steam engine and the technological impacts on nineteenth-century domestic life. Among the distinguished contributors are Lynn White, A. Rupert Hall, Eugene S. Ferguson, and John B. Rae. Volume two concentrates on twentieth century developments in the United States. There is well-rounded coverage of many pertinent

developments including the computer, the automobile, nuclear power, electronics, space travel. Corresponding social developments, particularly in government policy, also receive attention.

Mumford, Lewis. The Myth of the Machine. V. 1: Technics and Human Development. V. 2: The Pentagon of Power. Harcourt Brace Jovanovich, 1967-70.

The present over-commitment to technics is, Mumford contends, due to a misinterpretation of the whole course of human development. That man is primarily a tool-maker is a myth. Rather it is man's mind, with its powers expressed in dreams and symbols, that is the "ultimate criterion of man's biological and cultural success." Mumford applies William James's statement to both science and technology:

... this systematic denial on science's part of the personality as a condition of events, this rigorous belief that in its own essential and innermost nature our world is a strictly impersonal world, may conceivably, as the whirligig of time goes round, prove to be the very defect that our descendants will be most surprised at in our boasted science, the omission that to their eyes will most tend to make it look perspectiveless and short.

A widened interpretation of the entire course of human development is presented in these two volumes with the purpose of questioning the present commitment to technical progress as an end in itself. Mumford finds the archetypal "mega-technics" in the vast machines composed of human parts that built the pyramids. These colossal tombs are an enduring symbol: "As for the great Egyptian pyramids, what are they but the precise static equivalents of our own space rockets? Both devices for securing, at an extravagant cost, a passage to Heaven for the favored few." Mumford's heroes are the self-designers with an intimate understanding of nature: Audubon, Olmsted, Emerson, Marsh, Melville, Whitman. There is criticism of the surface flashiness of Buckminster Fuller and Marshall McLuhan. To restore control over our machines, we are challenged to turn the "power complex into an organic complex, and a money economy into a life economy."

Mumford, Lewis. Technics and Civilization. 1934. New York: Harcourt, Brace, Jovanovich, 1963.

An early Mumford work, important for its statement of his originally favorable attitude toward technology: "the machine itself makes no demands and holds out no promises; it is the human spirit that makes demands and keeps promises." Earlier portions of the book trace the "change of

mind" that permitted and accompanied technological advance. Mumford's famous essay identifying monastic regulation and the clock as the origin of the idea of abstract time is here. He also locates, in early eras, prototypes for machines, for industrial organization, for inorganic environments (the first being the mine). He sees the growth of technics as divisible into three eras based on source of power and basic material used: the eotechnic (water and wood); paleotechnic (coal and iron); neotechnic (electricity and alloy). Throughout, he observes trends toward the diminished use of human prime movers and the separation of energy production from utilization. His portrayal of the paleotechnic era is particularly scathing; he argues that it merely vulgarized and disseminated methods and goods developed in the preceding era, while wreaking a social and economic havoc only in this century being repaired. Mumford has numerous suggestions for accelerating these improvements.

White, Lynn, Jr. Machina Ex Deo: Essays in the Dynamism of Western Culture. Cambridge, Mass.: MIT Press, 1968.

The essays in this collection examine the cultural context, mainly Hellenic and Christian, from which our science and technology has evolved. White sensitively explores the religious origins of the present civilization, that is, "the sources of our faith in science today and . . . the well-springs of motivation that lead man to pursue science." Technology is identified as a spiritual search for "a new order of plenty, of mobility, of personal freedom." In the essay "The Historical Roots of Our Ecologic Crisis," the author explains that the merging of aristocratic science and empirical, work-oriented technology was a democratic revolution which fused brain and hand into a "functional unity." Today most of our traditional symbols have been "broken;" therefore, man is unable to cope with machine-age experience. White contends that symbols are essential: "we can know fact only in terms of fancy." Engineers have little deep understanding of their profession because of an inability to contemplate their technology from an aesthetic point of view. They must begin to look at their creations as human phenomena. It is only in this way that they will "get hooked" and, like that of an artist, their dedication will contain "an element of falling in love; an experience like religious conversion, however quiet."

4. ART

Benthall, Jonathan. Science and Technology in Art Today. New York: Praeger, 1972.

Concerned with contemporary art that exhibits a dominant interaction with science and technology, Benthall discusses both theory and application of the symbolic merging of aesthetics and technics. The focus is on the utilization of new technologies and media: photography, the computer, laser holography, and kinetic art. But Benthall does not isolate the artistic aspects of media; instead he asserts the necessity of an integrated understanding of the social, economic, industrial, and aesthetic effects of specific technologies. The sociology of the medium of photography, for example, is a profound subject for inquiry. Consider the personality of Hawthorne's daguerreotypist, Holgrave, in The House of The Seven Gables, and the influence Antonioni or Bergman have had on our manner of seeing. The partnership of art and media, Benthall believes, will be followed by a linking of art and ecology--as exemplified by the huge orange nylon curtain draped across a Colorado Valley in 1972. Benthall's experience as a systems engineer must have aided his comfortable understanding of the interaction of art with technology. His work can serve as an analysis of what Davis, in Art and the Future, illustrates.

Burnham, Jack. Beyond Modern Sculpture; the Effects of Science and Technology on the Sculpture of This Century. New York: George Braziller, 1968.

The stylistic changes of modern sculpture are seen to have been precipitated by the intellectual authority increasingly invested in science and technology. Burnham believes that critical attention to the psychical impetus toward abstraction has caused a lack of attention to the influence of material developments on contemporary art. Modern sculpture's values of "extension rather than containment, dynamism instead of mass" have replaced the depiction of totemic objects with the creation of life-simulating systems. Sustained through the use of technology, these interacting mobilizations symbolically reflect the human will to synthetically create life by means of machines. Discussion of computer art, light sculpture, robot and kinetic art demonstrates that technique is "in the driver's seat." The scientific model is repeatedly shown to be a stimulus for forms of sculpture. Burnham sees the outcome of technology's influence on art to be the appearance, before the year 2000, of intelligent automata with the capacity for reciprocal relationships with human beings--"living" man-machine systems.

Davis, Douglas. Art and the Future: a History/Prophecy of the Collaboration Between Science, Technology and Art. New York: Praeger, 1977.

Recognizing that art, as well as society, has grown extremely dependent on science and technology, Davis explores the direction of the symbiosis. The three formal divisions of the book provide a history of the sciences in 20th-century art, a group of interviews with artist-engineer-scientists, and a prediction of the future of the arts. Davis contends that artists of this century have "regarded technology as both a philosophical-propagandistic and an esthetic tool" and have turned away from "the ego to the machine to make art." The conversations and statements from leading artists reveal that the machine is irresistible. The work of artist-engineer hybrids such as Kepes, Tinguely, Takis, Rauschenberg, Paik, Seawright, Stern guide us from clanking fun and self-destruct machines to computer-generated animated film, argon and helium-neon lasers. It is evident that as art and science continue to fuse, the result is closer to science. Pure science (laser beams and computers) can stand alone as art.

Kepes, Gyorgy. The New Landscape in Art and Science. Chicago: Paul Theobald and Co., 1956.

Selectivity of vision has allowed us to ignore much of the menacing and confusing elements in the modern world. Kepes believes that by utilizing the powers of science and technology to display both microscopic and macroscopic structures, form and unity will be apprehended on a sensed and emotional level rather than on the rational level alone. What is needed to achieve harmony in our inner and outer worlds is a more integrated vision--to "assimilate with the scientist's brain, the poet's heart, the painter's eyes." By presenting pictures made by scientists and engineers for practical purposes and accompanying them with commentary by artists, scientists, and engineers including Giedion, Gropius, Wiener, Richard Wilbur, and Hayakawa, Kepes makes the "data" of the "new landscape" available to the senses. The perception of form-function relationships and structural insights, achieved by the joining of rational understanding with intuitive sensibility, unites science and art.

Kepes, Gyorgy, editor. Structure in Art and in Science. New York: George Braziller, 1965.

The ability to see the world as an interconnected whole, what Kepes terms a sense of structure, is necessary for our further cultural revolution. This group of essays considers the correspondence between the structural characteristics of natural and artistic forms. Divided into

two parts, the first section, including an essay by Cyril Stanley Smith, provides a scientific approach to the structuring process in nature. Papers in the second section apply structural principles to man-made forms. Luigi Nervi discusses the link between the designer's knowledge of natural processes and his creation of individual forms such as buildings and bridges. Japanese architects Maki and Ohtaka execute gigantic city-scapes which organize urban dynamics into systems of metropolitan relationships and utilize technology as a tool for order.

Klingender, Francis D. Art and the Industrial Revolution. New York: Schocken Books, 1970.

The book's title is a bit misleading, as Klingender covers only English developments and art. As such, the work is less valuable as a review of new forms of art and literature inspired by technical developments of the period. Engineering drawings and documentaries improved in accuracy and artistry; Klingender notes that though they were "a pure expression of the rational element, they are yet relieved by flashes of sentiment." The emergence of the realist, of the entrepreneur-artist (best exemplified by Josiah Wedgwood) and of the artistic social reformer is faithfully traced. The book is impressive in detail of observation and erudition, as well as the occasional flashes of insight into the era. Amply illustrated.

Kouwenhoven, John A. Made in America: The Arts in Modern American Civilization. 1948. Available as: Arts in Modern American Civilization. New York: Norton, 1967.

The American tradition in art developed from a conflict of European taste with the functional patterns of both settlement-builders on the frontier and technological design. The "vernacular," that is, the forms produced by people dealing with an unprecedented environment, emerged, in Kouwenhoven's view, the victor. What was originally purely functional frequently evolved into a unique "democratic-technical" beauty. The author traces this process with attention to specific implements and to prairie construction, railroads, bridges, architecture, literature, painting, jazz, and the cinema. The European style and propensity for solitary reflection adopted by such artists as Henry James, Hawthorne, Cassatt, and Whistler made them incapable of depicting the constantly evolving American scene with the relish of Whitman, Eakins, and Twain. The aesthetic quality of American Technology was not unrecognized. In 1876 Bartholdi saw in the Corliss engine "the beauty and almost the grace of the human form." In 1883 Oscar Wilde commented: "I have

always wished to believe that the line of strength and the line of beauty are one. That wish was realized when I contemplated American machinery." Judiciously chosen illustrations, which portray the art in American machine design, and extensive documentation compliment the volume.

Kranz, Stewart. Science and Technology in the Arts: A Tour Through the Realm of Science and Art. New York: Van Nostrand Reinhold, 1974.

The result of a six-year field study by a journalist, this large and heavily illustrated volume documents technology's impact on many areas of contemporary art. Interviewed are ninety-five "leading artists, engineers, scientists and critics" on their own work and views. Some interviews are devoted to the technical innovations that have extended the human senses, some of which have been taken up by artists; these include the scanning electron microscope, x-rays, voiceprints. "Bridges" between science and art (architecture, industrial design, computer-generated design) and strictly artistic endeavors (inter-media, environmental art presentations, spectator art) receive ample attention. Necessary changes in museums to accommodate the new art are discussed with critics and museum personnel. In all, the book overpowers the reader (viewer?) with the frenzy of contemporary artists' efforts to understand, utilize and transcend available technologies.

Pontus Hulten, K.G. The Machine: As Seen at the End of the Mechanical Age. New York: Museum of Modern Art, 1968. Dist. by New York Graphic Society.

This exhibition catalog presents extensive commentary and bibliography along with reproductions of a collection of artistic comments on technology by artists of the Western world. Pontus Hulten dedicates the exhibition to the mechanical machine, defined as "an imitation of our muscles," that is now threatened by electronic and chemical devices "which imitate the processes of the brain and nervous system." Works are arranged chronologically resulting in a detailed study of changing attitudes toward technology. The aesthetic curiosity of the Medieval and Renaissance world, exemplified by Da Vinci, is replaced by the utilitarianism of the eighteenth and nineteenth centuries, as seen in Jacquet-Droz's automata and the engines of Cugnot and Boydell. The change in twentieth-century interpretations of the machine proves to be dramatic. The fascinated tinkering "mechanolotry" and optimism of the Dadaists and Constructivists is effectively illustrated by Balla's paintings, Moholy-Nagy's light-space modulator and Calder's mechanized mobiles.

But scepticism and disillusion begins in the 1930s leading eventually to disgust and fear. Chaplin's plea for humanity in the films Modern Times and The Dictator is followed by Tinguely's self-destruct metamatics and Keinholz's ironic sculptures "Back Seat Dodge" and "The Friendly Grey Computer." The Pop artists represent a recent attempt to reestablish a better relationship with technology. Their work demonstrates that machines are created by human intellect and are related to the human body. Pontus Hulten paraphrases Tristan Tzara: "No one can escape from the machine. Only the machine can enable you to escape from destiny."

## 5. ARCHITECTURE AND URBAN DESIGN

Banham, Reyner. Theory and Design in the First Machine Age. New York: Praeger, 1967.

The first thirty years of the twentieth century (the "First Machine Age") produced not only a crop of first-rate and radically new architects and schools, but a mass of theoretical writing scattered through period magazines, books, and manuscripts. It is this material that Banham has valiantly gathered and analyzed in a book which traces the development of architectural ideas of the period. The first section searches for "predisposing causes" in the writings of "rationalists and academics" in France, England and Germany during the century's first decade and a half. Following sections look at Italy and the Futurists, Holland and de Stijl, Paris and Le Corbusier and Germany's Bauhaus and the development of an international style. Banham has much to say about the relationship between architecture and technological advance, but, in the end, poses the relationship as a paradox. He observes that architects in this century have learned that it is difficult to keep up with technology without tossing aside the entire "cultural load" of the profession. But if one refuses, technology yet moves, and the designer may find his work obsolete. Though expressed as a paradox, Banham's view is certainly more optimistic than that of Giedion. Good notes and indexes.

Fuller, R. Buckminster. Ideas and Integrities. 1963. New York: Macmillan, 1969.

A complex, sometimes revealing, often obstruse collection of autobiographical essays. Intimate details of the author's personal and social life in the twenties are interwoven, in the initial chapters, with general observations on the international style and its influence on Fuller's early work. In several essays, he discusses the appropriate, very technical education required for contemporary architects. A few older articles are included in their entirety; of these, the most significant are that on "fluid geography;" and "I Figure," a visionary article on postwar housing and materials shortages. The latter part of the volume, devoted to domes and to Fuller's wholistic approach to design culminates in an essay called "Total Thinking," on world planning and the "continuous man." Ultimately, he calls for an abandonment of the architectural past, prompted by the realization that it is from such developments as space technology, not the building arts, that current designers are finding inspiration.

Giedion, Siegfried. Space, Time and Architecture: the Growth of a New Tradition. Cambridge, Mass.: Harvard University Press, 1967. 5th ed.

A large and important book that has gone through many editions. Earlier chapters construct an elaborate case for the author's thesis that rapid advances in urban planning and flexible, harmonious design made during the Renaissance and Baroque periods were cut short upon the advance of the industrial age. The machine era brought the "destruction of man's inner quiet and security" as well as outer quiet. The individual was "devoured." The mayhem is reflected in the eclectic architecture, the unplanned cities of the period. A schism developed between engineer and architect to be healed only in the following century. At length, he traces the work of those responsible for binding the wounds, the giants of twentieth century architecture--Wright, Gropius, Le Corbusier, Mies Van Der Rohe. The detail of Giedion's research into and interpretation of small but significant events of recent architectural history is impressive. Trends in urban planning are discussed. He concludes: "what we have to do in the realm of architecture is to find a method of linking rationality with the organic in such a way that the organic becomes dominant and rationality is reduced to a normal position."

Le Corbusier. The Radiant City: Elements of a Doctrine of Urbanism to be Used as the Basis of Our Machine-Age Civilization. 1933. Willows, CA.: Orion Press, 1967.

The contemporary city needed for our machine civilization must be developed by an architecture responsive to the modern consciousness. Le Corbusier pleads for an understanding of the man for whom the home is to be built. A respect for individual liberty is the cornerstone of all plans and primary consideration must be given to the leisure brought by the new age. This approach to urban design considers the relationships of buildings to surrounding areas, vehicular and pedestrian traffic flow, the dwelling as a machine for living. Abundant illustrations visualize the author's own dreams for the future city.

## 6. LITERATURE, CRITICAL STUDIES

Millegas, Mark R. The Future as Nightmare: H.G. Wells and the Anti-Utopians. New York: Oxford University Press, 1967.

Although "Wellsianism" became a label for a world-view in which scientists and engineers form an elite corps, mechanical super-gadgets proliferate, and optimism in the future is rarely questioned, Millegas finds many of the elements of major twentieth-century dystopian visions in Wells's scientific romances of the 1890s. Literary motifs from The Time Machine, A Modern Utopia, When the Sleeper Wakes, First Men in the Moon continually recur from Zamyatin, Huxley and Orwell, to C. S. Lewis, Burgess, Bradbury, and Vonnegut. B. F. Skinner seems to have "borrowed" most of his radical "new" ideas from two Wells novels. Wells developed a perspective which is characterized by detachment and a preoccupation with the future. He "saw men chemically and anatomically, the world astronomically," and the present is considered only as "material for the future." What his early fiction generates is not scientific optimism, but the cosmic despair that emerges so powerfully from The Time Machine. Wells does argue persuasively for the achievement of human happiness through the utilization of science and technology in the planned world state. Forster, in "The Machine Stops," exposes the potential of such a state to "stifle the individual, crush human ingenuity and inventiveness, destroy art, and enfeeble men--in fact turn them into machines." Many of the Wellsian happiness tools are transformed into engines of destruction in Zamyatin's We, Brave New World, 1984, and Fahrenheit 451. Vonnegut's Player Piano projects the Wellsian vision into our automated future. The masses, who smash the machines which regulate their lives, cannot resist tinkering with the components. Zamyatin, calling Wells's scientific romances "urban fairy tales," comments as follows in his Herbert Wells (1922):

But imagine a country where the asphalt is the only fertile soil. On that soil, there is a dense jungle of only factory smokestacks; there are animals of only one breed--automobiles; and there is no spring fragrance except that of gasoline. This stony, asphalt, iron, gasoline, mechanical country is today's twentieth-century London, and, naturally, it should have grown its own iron and automobile goblins, produced its own mechanical and chemical fairy tales. . . . they have been told by Herbert Wells.

Marx, Leo. The Machine in the Garden. 1964. New York: Oxford University Press, 1964.

The myths of the "American Adam" and the "Virgin Land," which concretize a dream of innocence regained, are powerful exemplars of how Americans view themselves. A tension developed early in our history, however, as society moved away from innocence and gardens to cities, machines, and war. Marx traces the adaptation of the "pastoral ideal," a metaphor of "the middle landscape" between naive primitivism and corrupt civilization, to "conditions of life in the New World. . . and its subsequent transformation under the impact of industrialism." Through an exploration of American literary response to the general culture, Marx dramatically unfolds the effects of machine technology upon consciousness. Industrialization and pastoralism were at first fused in our literature without contradiction; however, approaching the present, the machine is seen as a counterforce against the garden and is represented by increasingly violent images. Emerson and Whitman display an acceptance of the machine in a rhetoric of the "technological sublime." But Hawthorne, Melville, and Twain are unable to reconcile the tension between the dream and reality, between the myth of the garden and an industrial history. Marx demonstrates the literary perception of the dislocation of mind and emotion caused by two systems of value that society cannot resolve with our existing myths. Finally, in Fitzgerald's The Great Gatsby, the tension ends in tragedy. The "middle landscape" is transformed by the machine into a region of terror--an ash heap "half way between New York and West Egg."

Meakin, David. Man and Work: Literature and Culture in Industrial Society. New York: Holmes and Meier, 1976.

The division of labor, which reduced each worker to a mere fragment of the whole and fashioned him into an adjunct of the machine he tends, has resulted in an estrangement from "nature"--human and environmental. Gosselized by Frederick Taylor's work-man studies, assembly-line automation stripped the worker of invention, responsibility, and creativity in the name of efficiency. Meakin outlines a continuum of literary response to the alienation and rootlessness of the isolated worker as well as the cultural deprivation resulting from technological civilization. Orwell recognized the "perverse dynamism" of industry: "Mechanization leads to the decay of taste, the decay of taste leads to the demand for machine-made articles and hence to more mechanization, and so a vicious circle is established." The impoverishment of work leads to the

degradation of popular culture--creativity is sublimated into consumerism. The idea that work must have a value in itself if men are to realize their potential has been a dominant theme of Western literature since the 18th century. Many writers Meakin considers looked back with romantic and sentimental reverence to a pre-industrial age. Rousseau relapsed into pastoral primitivism while Ruskin, Morris, and Weil preferred the craft guilds of the Middle Ages. Hardy escaped the city to find an elemental kinship between man and nature. Meakin points out that several of these liberators succeeded only in binding men to different webs. "Nostalgia is cheap witchcraft, and even cheaper politics." Ruskin demanded that all creatures be forced to do right and that in his utopia he was to be the in/allible source of wisdom. Although now often considered "weird or cranky," the preoccupations of writers from Blake to Wesker have become urgent in the crisis of conscience that has surfaced in our technological society. Meakin finds in this European literary tradition speculation not only on the dangerous aspects of industrialism, but also on the possibility of salvation through "a non-ascetic ethic of creative, fulfilling work." Appreciation of this literature may assist us in the urgently necessary revision of our notions of art, community, and culture.

Sussman, Herbert L. Victorians and the Machine: the Literary Response to Technology. Cambridge: Harvard University Press, 1968.

The English Victorians, the first people to live in a culture dominated by technology, quickly realized that the machine created profound changes in intellectual and emotional life. Sussman concentrates on seven writers who utilize the symbol of the machine "to express the interrelationships of technological change, psychic well-being, and mechanistic thought." Carlyle, Dickens, Ruskin, Morris, Butler, Wells, and Kipling express concern for the synthesis of industrial mechanization and philosophical mechanism. Their attitude is ambivalent; the machine is a metonymy for progress but it also represents the destruction of emotional life. The predominant anti-machine attitude, then, results not so much from a dislike of technology but from an opposition to mechanistic, rational modes of thought. Dickens and Morris bitterly attack the attempt to regulate social activity while Carlyle and Butler reject the explanation of natural phenomena by the scientific method. Late in the century, Wells and Kipling are able to celebrate technology through images derived from the machine, but Wells's scientific romances still dramatize "the necessary amorality of the scientific intellect."

Sypher, Wylie. Literature and Technology: the Alien Vision. New York: Random House, 1968.

Beginning in the nineteenth century, method became the essence not only of science and technology but also of the arts. Sypher considers how experiments in realism, impressionism, symbolism, and decadence resulted from a reliance on method rather than an imitation of Nature. The scientific method's controlled observation, which developed abstract laws not based on actuality, and the asceticism of method in literature and art made the artist and scientist alike alien from life. Style became a "technological artifice." While twentieth-century art voices a reaction against this distancing and a need to participate, technologists are reintroducing the craft ideal. Technology and art, rather than being antagonistic, will, Sypher contends, continue to stimulate each other especially in "vanguard phases."

West, Thomas Reed. Flesh of Steel: Literature and the Machine in American Culture. Nashville: Vanderbilt University Press, 1967.

The twentieth-century literary expression of reaction to the machine defines a duality of attributes. "Discipline," a blending of monotony, integrated complexity, exactness, and form seems polarized against a character of "energy" which joins power, profusion, and massiveness. West discusses the contrast and intricate interplay of these polarities in the works of Sherwood Anderson, Waldo Frank, Dos Passos, Veblen, Sandburg, Harold Stearns, Mumford, and Sinclair Lewis. He thus includes both repudiations and affirmations to technology. These particular authors also integrate their views of the machine with social and political aspects of the American national experience. While "energy" and "discipline" hardly seem the most appropriate concepts with which to categorize this literary response, West's book also suffers from the author's inability to cleanly differentiate the dualism. He must conclude that generally the tension is relaxed in unity.

## 7. FICTION AND POETRY

Asimov, Isaac. I, Robot. 1950. New York: Fawcett World Library, 1970.

In this collection of tales, cybernetics advances from the mute nursemaid robot Robbie, through Cutie, a self-proclaimed prophet, and Herbie the liar with good intentions, to Brain, the super computer who conquers space and time by creating a vehicle with Hyperatomic Drive, and Machines which rule the world by controlling economic forces. The unique appeal of these stories lies in Asimov's ability to involve the reader emotionally with the androids. While the supporting cast of humans are stereotypes, e.g. the soulless shrew mother, frigid, pinched-mouthed career woman, grim scientists ruled by rationality accompanied by a fool sidekick, robots have devastating psychological problems, distinct personalities, and are more trustworthy, faithful, and sensitive than man. The "three laws of robotics" create constant tension between ego, self-preservation, and protection of the Master. Man asks too much: Robbie is hurt by an unjust accusation, Speedy becomes drunk when conflicting demands run him in circles, Dave freaks out when given more responsibility than his circuits can handle, Nestor 10 is persecuted for so expertly carrying out his Master's order to "get lost." Or the robots struggle desperately to outsmart man in order to protect him: Cutie must become obsessed with his own superiority to save his inefficient creators, Herbie hates math and reads novels in order to understand human emotions, Brain becomes a practical joker to escape the pressure of reality where he must place man in danger. Robots, superior both physically and intellectually and guided by a built-in law to protect all humans from harm, "stand between mankind and destruction." Robbie can "stay with us until he rusts."

Bellamy, Edward. Looking Backward. 1888. Cambridge, Mass.: Harvard University Press, 1967.

Boston in the year 2000, a garden of sculpture, covered moving travelways, and massive collective dining halls, is a visual emblem of the replacement of capitalist individualism and class distinctions with universal solidarity. When Julian West awakes from his over one-hundred year suspended animation, he finds a citizenry so attuned to the universal good that individual drives for distinction or power have been curbed. This integrated consciousness has been achieved through efficient use of machine technology.

Music is piped into every room, luxurious merchandise is delivered to all via pneumatic tubes. Everyone is a member of the industrial army, a military organization of officers and rank and file workers. All tasks are done with professionalism, but spontaneity has been replaced by total programming. All tasks are performed without regard for personal satisfaction and as a duty to the nation. The serenity and harmony exists because passion has been eliminated along with self concern. Thus, the emotionless army can work like an efficient machine. Bellamy's futuristic views had a significant influence on Wells and later became fuel for twentieth-century dystopias.

Bradbury, Ray. The Martian Chronicles. 1950. New York: Doubleday, 1973.

The descent of man on Mars is shrouded in mythic and sexual overtones. Like Zeus, Earthman plants his seed by the violent rape of an unsuspecting, innocent, yet fertile body. With a civilization eons older than that of Earth, Mars is serene and beautiful because its wise inhabitants stopped technology before it became more powerful than themselves. These "found" people combine art and nature, science and religion into "as good a life as possible." Man's powerful rockets bring not only chicken pox to annihilate the natives, but also beer cans to litter the canals, drunken vomit which defiles Martian art, gas stations, and even Sam's Hot Dogs. Spender, the avenger, defends against the invasion but he is outnumbered by swarms of men with "mouths fringed with nails" who build a replica of technological civilization. After man abandons Mars when called to "come home" to an Earth racked by atomic war, his machines remain as a testament to uselessness--the dynamos hum in the empty city and a family of robots continues its programmed domestic ritual. Like Poe whom he exalts, Bradbury worships the imagination which, he feels, is being destroyed by mechanical paranoia. The result will be absurdities like metal cleaning mice, computerized meals selected, measured, and prepared by machines, a home run by an electronic brain in the attic. But Bradbury is a romantic--a few enlightened men and their families escape the atomic death of Earth and people Mars a second time. After destroying their engines, they find the fountain of life in a Martian canal.

Brunner, John. Stand on Zanzibar. 1968. New York: Ballantine Books, Inc., 1972.

Dos Passos' collage of literary forms and McLuhan's immediate impact are incorporated in this dystopian

portrayal of the world in 2010. "The future has acquired period charm, like the Victorian Age," the Times Literary Supplement comments, and, indeed, Brunner's panoramic excursion is a glossy depiction of a society extrapolated so obviously from the late 1960s that it smacks of quaintness. However, the frenzy, repulsion, extreme constriction, and sensual indulgence of an over-populated, computer-run, and big-business governed world are effectively achieved. The landscape of decay includes genetically molded pets, legions of people zonked on psychedelic chemicals, girls wearing radio-dresslets and otherwise costumed to resemble machines, sophisticated sabotage devices, a domed New York City, incest, and a new vocabulary of curses. Genetic optimization is the major concern. Despite strict regulation of reproduction, the aim of mankind is to produce a super race; and on a smaller scale, expectant parents still are hooked on the Savior dream. Donald Hogan, a mild-mannered intellectual, is "eptified" into a killer-agent in order to kidnap the world's greatest geneticist; while Norman House, a tool of conglomerate General Technics, and radical sociologist Chad Mulligan (a blend of Kerouac, Ginsberg, and McLuhan) discover a mutant pacifying gene in an isolated African tribe. Since the gene creates an odor which dulls aggressive tendencies, Mulligan figures that super computer Shalmaneser can synthetically mass produce the odor--social control, or rather, "brotherly love out of an aerosol can."

Clarke, Arthur C. 2001 A Space Odyssey. New York: Norton, 1968.

Mechanical emotions threaten to abort the spaceship Discovery's mission to Jupiter. The computer Hal, painstakingly built and trained to approximate the capabilities of the human brain, is too much of a success. Hal has tender feelings for his mortal companions and is rendered irrational by the guilt generated by the necessity to follow commands which force him to be a traitor to Poole and Bowman. Clarke comments with irony: "Like his makers, Hal had been created innocent; but all too soon, a snake had entered his electronic Eden." The "brain," be it human or mechanical, is a force for chaos in the universe; therefore, to preserve mortal life, the higher centers of the "brilliant brain" must be "cut out" leaving only the "automatic regulating systems in operation." Man must be controlled by technology. The three astronauts comatose in the hibernaculum are physically preserved by replacing their psychological being with mechanical regulation. In contrast, Bowman, by traveling through the crystal slab, expands his brain and passes beyond the necessities of matter. With a will that dominates the universe, he whimsically annihilates the Earth but is unable to devise any

purposive plan for his kingdom: "For though he was master of the world, he was not quite sure what to do next."

Clemens, Samuel (Mark Twain). A Connecticut Yankee in King Arthur's Court. New York: Harper and Row, 1889.

This yarn records the adventures of a cocky Yankee, who with ingenuity and perseverance, "learned to make everything and invent anything." Unfortunately, he can not resist a good fight, and one particularly heavy blow knocks him into the Arthurian Age. There the democrat discovers a thoroughly rotten nobility, and an incredible lack of (and not much interest in) technological advance. Having gained an esteemed position through the old eclipse-prediction trick, he gradually introduces new ways: toothpaste, printing, advertising. Clandestinely, he develops factories and workshops to be unveiled after a great joust. Deep contrasts between the middle ages and the nineteenth century appear in such incongruous introductions as hard-sell advertising in Gutenberg type, or a revolver brandished in a chivalrous contest. The reader finds it difficult to gleefully agree with Hank Morgan, the Yankee, that "somehow every time the magic of fol-de-rol tried conclusions with the magic of science, the magic of fol-de-rol got left."

Crane, Hart. The Bridge. 1930. In: The Complete Poems and Selected Letters and Prose of Hart Crane. Edited by Brom Weber. New York: Liveright, 1966.

In the brief essay, "Modern Poetry," written in the same year The Bridge was published, Crane discusses the poet's unique responsibility to integrate the machine and human consciousness:

For unless poetry can absorb the machine, i.e., acclimatize it as naturally and casually as trees, cattle, galleons, castles and all other human associations of the past, then poetry has failed of its full contemporary function. . . . It demands . . . an extraordinary capacity for surrender, at least temporarily, to the sensations of urban life. Machinery will tend to lose its sensational glamour and appear in its true subsidiary order in human life as use and continual poetic allusion subdue its novelty. For, contrary to general prejudice, the wonderment experienced in watching nose dives is of less immediate creative promise to poetry than the familiar gesture of a motorist in the modest act of shifting gears . . . mere romantic speculation on the power and beauty of machinery keeps it at a continual remove; it can not act creatively in our

lives until, like the unconscious nervous responses of our bodies, its connotations emanate from within--forming as spontaneous a terminology of poetic reference as the bucolic world of pasture, plow, and barn.

Brooklyn Bridge, the structure brought into being by a paralysed architect, is for Crane the manifestation of how man, as builder, can realize his ultimate nature. The "telepathy of wires . . . granite and steel" bounds upward in "arching strands of song!" The indigenous rhythms, forms, and forces of America, as celebrated by Whitman, "flung the span . . . Of that great Bridge, our Myth." But the 20th-century cacophony is a debasement of man's powers. Macadam and toothpaste ads replace the "steeled Cognizance":

the telegraphic night coming on Thomas  
a Ediford--and whistling down the tracks  
a headlight rushing with the sound--can you  
imagine--while an EXpress makes time like  
SCIENCE--COMMERCE and the HOLYGHOST  
RADIO ROARS IN EVERY HOME WE HAVE THE NORTHPOLE  
WALLSTREET AND VIRGINBIRTH WITHOUT STONES OR  
WIRES OR EVEN RUNNING brooks connecting ea's

. . . So the 20th Century--so  
whizzed the Limited--roared by and left

We have the Bridge, though, a massive, mechanical mastery of urban chaos and, for Crane, a defiant defense against surrender and regression in the sea.

Dickens, Charles. Hard Times. 1854. New York: Norton Critical Editions, 1967.

Coketown is described by imagery which vividly reveals the dangerous unnaturalness of the environment:

It was a town of red brick, or of brick that would have been red if the smoke and ashes had allowed it; but, as matters stood it was a town of unnatural red and black like the painted face of a savage. It was a town of machinery and tall chimneys, out of which interminable serpents of smoke trailed themselves for ever and ever, and never got uncoiled. It had a black canal in it, and a river that ran purple with ill-smelling dye, and vast piles of buildings full of windows where the piston of the steam-engine worked monotonously up and down, like the head of an elephant in a state of melancholy madness.

Dickens' concern is the effect of mechanization on men's minds. Both the work as a machine-tender and the intellectual mechanism of those who consider men as merely additional interchangeable parts of their machines will destroy the imagination and moral sense. Louisa, when urged into a rational and utilitarian marriage to Bounderby, expresses not only her stifled passion but also the human emotions in all of the workers that will never be regimented into mechanical habit: "There seems to be nothing there but languid and monotonous smoke, yet when the night comes, Fire bursts out, father." For Dickens it is education that has attempted to mold man into machine. M'Choakumchild's method of teaching is the application of standardized methods and materials to repeatedly produce an identical product. Teachers too are mass produced: "He and some one hundred and forty other schoolmasters had been lately turned at the same time, in the same factory, on the same principles, like so many pianoforte legs." More effectively than any other Victorian novel, Hard Times attacks the suppression of emotional impulse by utilitarian mechanization. But for Dickens, man endures; the staunch goodness and sympathetic feelings of Stephen and Rachel are never dominated by their surroundings.

Fitzgerald, F. Scott. The Great Gatsby. 1925. New York: Scribners.

Jay Gatsby, the archetypal American self-made man, creates a world for himself which, like his monetary success, is a product of technology and manipulation--a mansion (an architectural copy) with concrete swimming pool, a formal blue garden, and a garage full of cars. His Rolls Royce, above all, sums up his quality of life: "It was a rich cream color, bright with nickel, swollen here and there in its monstrous length with triumphant hat-boxes and supper-boxes and tool-boxes, and terraced with a labyrinth of windshields that mirrored a dozen suns." This flesh-colored vehicle is an extension of Gatsby; it is the embodiment of his sexual and financial power. Suggestions of the automobile also surround Daisy's friend Jordan Baker. Her name is a compound of two well-known American cars of the 1920s and she typifies the seductive, adventuresome, sporty, sleek Jordan coupe. Nick Carroway sees another kind of force in Gatsby--a "gift of hope" similar to that felt by the first Europeans to glimpse the "fresh, green breast of the new world." Gatsby is hypnotized by the green light at the end of Daisy's pier, but his romantic vision of a return to pastoral simplicity and innocence with Daisy is a myopic illusion. Daisy, too, is a product of the machine-dominated world which has stripped the American ideal of Eden. It is she who steers the "death

car." The automobile which symbolized all of Gatsby's dreams becomes the instrument of his destruction.

Huxley, Aldous. Brave New World. 1932. New York: Harper and Row, 1969.

The offspring of Zamyatin's We, Forster's "The Machine Stops," and the Wellsian utopias, Brave New World is a "nauseated rejection" of the modern world's utilization of science and technology for the modification and manipulation of the human species. Stability in the World State is achieved by conditioning the inhabitants to a comfortable lethargy. Brought to birth in laboratory bottles, and taught erotic games in kindergarten, the selected chromosomes mature to an adult world of soma and sex. Eugenic technology produces standardized humans particularly suited to specific work castes. The higher Alphas gestate under prime conditions while the drone Epsilons are stunted by a shortage of oxygen in their incubators. Everyone is passively amused by mechanical devices, and happiness is the total absence of physical suffering. There is no need for heroism in this society: "...being contented has none of the glamour of a good fight against misfortune, none of the picturesqueness of a struggle with temptation, or a fatal overthrow by passion or doubt. Happiness is never grand." Huxley's revulsion against the less than human "paradise of little fat men" was anticipated by Wells as evidenced by his comparison, in Men Like Gods, of the dreadful life with that of ease and comfort: "It is titanic, Sir, where this is merely tidy."

Lewis, Arthur O., ed. Of Men and Machines. New York: Dutton, 1963.

The writers in this anthology present various views of the relationship of men and machines. Capek considers whether machines are totally mechanical or if they have human attributes. For Bacon, Adam Smith, Sandburg in "The Hammer," the machine is man's greatest hope for a better life. Dickinson, Spender, and Whitman use mechanical rather than natural images to express a thing of beauty. In contrast, the Industrial Revolution and the development of "thinking machines" have inspired a predominant attitude of fear toward the machine. For Butler, Vonnegut in Player Piano, Huxley, Orwell, and Forster in "The Machine Stops," man is replaced, made dependent, and becomes the servant of the machine. He has no work and is reduced to something less than human. Physical destruction by his creation becomes an immediate threat. Considerations of the future include Watson's and Snow's programs for continued progress, as well as the grim foreboding of Aldiss and Bradbury.

Miller, Walter M., Jr. A Canticle for Leibowitz. 1954.  
Grege Press, 1975.

The monastery of the order of St. Leibowitz, founded after the devastation of a nuclear war, plays its role in the development of a new technological civilization which leads unhesitatingly to a second holocaust. Brother Kornhoer devotes his energies to the reconstruction of a dynamo in the basement of the abbey. By the Abbott's orders, once again the dynamo supplants the Virgin:

For the present, you will please take down the crucifix. It's the only suitable place for the lamp, it seems. Later we may change it. Now I realize this whole thing has disturbed your library, and perhaps your digestion, but we hope it's in the interests of progress.

Brother Francis unwittingly preserves technology by devoting years, all of his emotions, and finally his life to the preparation of an illuminated and embellished copy of a Leibowitz relic--which is actually a circuit blueprint for an automatic copier. However, man's fascination with technology, even at the cost of the repeated destruction of his civilization, is at least equaled by his need for mythic and sacred heroes. The passionate quest for canonization of Leibowitz, a Jewish military technician, is an ironic comment on man's desperation and the inadequacies of his non-technical cultural forms. The monastery is finally reduced to the role of impotent overseer of a voluntary euthanasia facility for hopeless radiation cases. But God and man endure to start a new cycle. Benjamin, the immortal Jew, meets his Savior in Mrs. Grales, the two-headed "tumater woman." Before the bombs fall, she forgives God and suddenly her old-lady-head shrivels while her second childlike head, hitherto always in a coma, awakes. "Rachel" is a creature in sinless, original grace.

Orwell, George. Nineteen Eighty-Four. 1949. New York:  
New American Library, 1971.

Because technology and scientific rationalism play a subsidiary role in this well-known dystopian novel, it presents an interesting contrast to Zamyatin's We which Orwell admired and drew heavily from. Social control is maintained by Big Brother over Winston Smith and his fellow citizens through a barrage of propaganda and slogans and through manipulation of language (Newspeak) rather than through an enculturation of mechanized thought patterns. Technological implements--telescopes, advanced instruments of torture--only permit the Thought Police to be everywhere. In the end it is "applied psychology" that ends Winston Smith's "crimethink."

7

Pynchon, Thomas. Gravity's Rainbow. New York: Viking, 1973.

With a brilliance beyond other contemporary writers, Pynchon's quest for our cultural inheritances proceeds through an examination of their manifestations in art and technology. His literary base of Moby Dick and Ulysses is only one element in a perspective more surely guided by the revelations about human nature to be found in mathematics, organic chemistry, behaviorist psychology, and the products of technology. Pynchon admits that the novelist's imagination is insufficient to reveal the nature of contemporary life without an understanding which embraces nonliterary elements in the modern world, e.g. science, mechanical paranoia, film, drugs, and comic books. Set in Europe near the end of World War II, action centers around the characters' search for the new Sangraal, a uniquely modified German supersonic V-2 rocket. The rocket takes possession of everyone. Lt. Tyrone Slothrop, who as an infant was subjected to the conditioning of his sexual reflexes by an experimenting behaviorist, maps out the rocket's attack points by becoming erotically aroused at times and places where the V-2 will soon fall. In fear of his rather metaphysical connection with the death machine, he runs around Europe trying to escape his identity but at one point dons a cape and pointed helmet looted from a Wagnerian opera company and dubs himself "Rocketman"--a comic book hero. Like Mailer, Pynchon sees a "charisma" in the rocket. Beyond the wires and mechanics there is "some joyful--and deeply irrational--force the State bureaucracy could never routinize, against which it could not prevail." R. Poirier, in Saturday Review, says that Pynchon is "locating the kinds of human consciousness that have been implanted in the instruments of technology and contemporary methods of analysis." With the Aryan youth, Gottfried, entombed within a shroud of Imipolex G. plastic inside the special V-2, the components of humanity--sex, love, dreams, Faustian illusions, death--are "fused into the Rocket's assembly and into its final trajectory."

Shelley, Mary. Frankenstein or, the Modern Prometheus. 1818. New York: New American Library, 1965.

The sudden critical attention in the mid 1970s to this novel is most likely due to our recognition of the power of technology to destroy its creator. Considered the first science fiction novel, Frankenstein chronicles the wanderings of a man who subordinates all of his human emotions and affections to a passion for science. His quest to create life is actually purely narcissistic and he succeeds in producing his own alter ego--an objectification of the evil in him. The final surrealist chase of man after monster in the frozen Arctic imagistically depicts the barrenness of self-love and man's dependence on Nature to control his technological abortions.

Vonnegut, Kurt. Player Piano. 1952. New York: Dell, 1974.

This first novel depicts a future America in which machines do most of the work, tended by a privileged, conformist class of technocrats. Most of the population is unemployed (unless in the army or the reclamation corps), uneducated, spiritless. The rather simple plot records the personal revolt of the head of the Ilium, New York works, one Paul Proteus. There are temporary, sometimes funny defeats of machinery and some satire on contemporary "rah-rah" corporate social conformities. But the real horror in Vonnegut's dystopia, effectively conveyed, is not automation but universal boredom.

Warburg, Jeremy, ed. The Industrial Muse. London: Oxford University Press, 1958.

The verse in this anthology of late eighteenth and nineteenth-century British poetry, written as a response to the rise of the industrial era in England, presents a statement against the way of life in factory towns and a recoiling from a mechanistic habit of mind. Although a few glorifications of the power of machines do appear, most of the spokesmen feel that the engines and dynamos have alienated them from the garden. They retreat from the barren ugliness of steam-generated cities and the spiritual desolation of the inhabitants into their individual selves. While this collection contains works of prominent poets such as Wordsworth, Tennyson, Hopkins, Kipling, Spender, and Auden, much attention is given to the inclusion of verse from lesser known writers of the period, especially women.

Wells, H.G. A Modern Utopia. 1905. Lincoln: University of Nebraska Press, 1967.

Mumford remarks that Wells wrote the "quintessential" utopia. This novel extends its predecessors in two essential respects: A Modern Utopia is planet-wide and it is formed by science and technology. Freed from dulling work, the utopians maximize individual growth and creativity. The world is full of beautiful machines, and Wells's manifest liking for them is obvious: "... were our political and social and moral devices only as well contrived to their ends as a linotype machine, an anti-septic operating plant, or an electric tram-car, there need now at the present moment be no appreciable toil in the world and only the smallest fraction of the pain, the fear, and the anxiety that now makes human life so doubtful in its value." Wells's futuristic imagination has proved to be profoundly accurate. For example, the most viable rate of exchange for this scientifically planned state is conceived to be energy.

Wells, H. G. The Time Machine. 1895. New York: Dutton, 1972.  
Also available in: H. G. Wells. Seven Science Fiction Novels. New York: Dover, c1934, reprint.

The genre of time travel literature was transformed into scientific romance by Wells. "Remarkably inspired fabrication of a mechanical device as transport vehicle to the future." The world of the year 802,701 justifies T. H. Muxley's "cosmic pessimism." A logical extension of the class distinctions created by industrialized England, two degenerate species populate the Earth. The Eloi, accustomed to the life of ease resulting from the complete subjugation of nature, have no more substance than a feeble prettiness. In contrast, the Morlocks, tenders of the machines, are pallid, chinless creatures with "great lidless, pinkish grey eyes." Because the machines require some intellect to maintain, the evolutionary process asserts itself when, as the food supply diminishes, the Morlocks emerge from the subterranean habitat to eat the Eloi. Exceedingly influential in the development of later dystopias, especially those of E. M. Forster and Aldous Huxley, The Time Machine establishes technology's role in the production of a future worse than the present.

Wells, H. G. When the Sleeper Wakes. New York: Harper, 1899.

Through the device of a sleeper who falls into a trance in Victorian England and awakes in the twenty-second century, Wells presents the effects of two hundred years of technological and scientific progress aided by capitalism. London, a "super city" inside a glass dome, is an inhuman, vast mechanical anthill. This metropolis of the future, as well as many of the images created here by Wells, are repeated in later dystopian literature. The family is replaced by common dining halls, Child Educational Refineries, glass incubator-like boxes to automatically care for babies, and even mechanical wet nurses. People watch kineto-tele-photographs (television) and listen to Babble Machines which blare forth news and propaganda. For the bosses and the middle class sensation seekers there are Pleasure Cities, "euthanasia," and psychic surgery performed by hypnosis. The great mass of the population, the "anaemic millions," is forced by the economic system to be no better than slaves. This Labour Company of machine-minders working in subterranean factories is in the process of evolving into a distinct race. Their feeble muscles, livid white lips and nostrils foretell their future as the Morlocks of the year 802701 in The Time Machine.

Whitman, Walt. Complete Poetry and Selected Prose by Walt Whitman. Edited by James E. Miller, Jr. Boston: Houghton Mifflin, Riverside Editions, 1959.

The Old World Muse migrates with undaunted freedom to Whitman's new age:

By thud of machinery and shrill steam-whistle undismay'd,  
Bluff'd not a bit by drain-pipe, gasometers, artificial  
fertilizers,  
Smiling and pleas'd with palpable intent to stay,  
She's here, install'd amid the kitchenware!

(Song of the Exposition)

While there may be humor here, it is not sarcasm. Whitman's democratic response embraces All. Technological achievement, as well as sensual emotions, is part of the celebration of man:

Steam power, the great express lines, gas, petroleum,  
These triumphs of our time, the Atlantic's delicate cable,  
The Pacific railroad, the Suez Canal, the Mont Cenis and  
Gothard and Hoosac tunnels, the Brooklyn Bridge,  
This earth all spann'd with iron rails, with lines of  
steamships threading every sea,  
Our own rondure, the current globe I bring.

(Song of the Exposition)

In his absorption, Whitman, with audacity and verve, fuses industry and its technical jargon into poetry. He sings the "strong light works of engineers":

The blast-furnace and the puddling-furnace, the loup-lump  
at the bottom of the melt at last, the rolling-mill,  
the stumpy bars of pig-iron, the strong, clean-shaped  
T-rail for railroads.

(A Song for Occupations)

Whitman takes no part in the critique of industrialization. His total receptivity and lack of discernment have been justly criticized. But for Whitman, the materialistic drive and inventions are preliminaries of an era of unity created by the poet:

After the great captains and engineers have accomplished  
their work,  
After the noble inventors, after the scientists, the  
chemist, the geologist, ethnologist,  
Finally shall come the poet worthy that name,  
The true son of God shall come singing his songs.  
.....

Nature and man shall be disjoin'd and diffused no more,  
the true son of God shall absolutely fuse them.

(A Passage to India)

While Whitman's simple-hearted love results in a naivete, his unfettered perspective encompasses all aspects of life in his time and also achieves a synthesis of man and the products of his technological energies.

Zamyatin, Eugene. Wg. 1924. Boston: Gregg Press, 1975.

A chilling terse dystopia by a Russian emigré. It is more an indictment of what Zamyatin perceived to be the extension of mechanization to all human activities than an expression of fear of the proliferation of machines. The story is told through the memoirs of D503, a mathematician (like the author) in the walled and concrete United State. There citizens wear numbers (an inseparable, indistinguishable "We"), live in isolated, but exposed glass cubicles. They march, work, and eat in synchrony, their seconds guided by a Table of Hours. It is a time-and-motion study writ large. D503 has been charged with overseeing the construction of the Integral, a spaceship that will carry the perfection of the United State to other worlds. Through a love affair, he develops a "soul," goes out-of-step, and becomes aware of a teeming living world outside the walls. The reflection of D503's spiritual transformation in the memoirs through a gradual embellishment of imagery and decreasing rationality reveals the author to be a master of stylistic control.

## 8. SOCIAL IMPACT, TECHNOLOGY ASSESSMENT

Dasbach, Joseph M., comp. Science for Society: a Bibliography. American Association for the Advancement of Science. Office of Science Education. Annual. 1970-present.

Designed to assist curriculum development and to supplement course work at the secondary and college levels, this bibliography covers books and journal articles dealing with "the interrelationships of human-kind, the environment, science, and technology." Short abstracts are provided as well as ideas for course outlines, modules, and independent study guides. Topics covered include: energy; environmental manipulation; ethics, values, responsibility and science; health care; pollution; population; technology and humankind. It is unfortunate that publications included are already several years old. The 1976 edition contains primarily material published in 1974.

Elliott, David and Ruth. The Control of Technology. London: Wykeham Publications Limited, 1976.

Developed from a course in the design and technology of man-made futures, the authors discuss the forces which control the interaction of modern society and technology. It is emphasized that man is not limited to a dichotomous choice between an authoritarian, interdependent high-technology or a self-determining low-technology. Technologies can be selected according to social goals. The concept that technology is "neutral" is rejected here, for it is the values of a society which determine the nature and design of its technologies. Some radical "blueprints" for societies in which the application of technology is under direct social control are presented and the type of social and economic structure which would foster advantageous control of future technological advances is considered.

Ellul, Jacques. The Technological Society. New York: Knopf, 1964.

In a complex and thickly argued work, the author presents his case for the growing pervasiveness of "technique as an organizing principle of all human activities." Ellul searches at length for an appropriate definition for the phenomenon. In one place, technique is the "totality of methods rationally arrived at and having absolute efficiency in every field of human endeavor;" in another, "means and the ensemble of means." The machine represents the "ideal toward which technique strives" and it is

through technique that machines are integrated into society. Much of the work is devoted to tracing the historical development of mechanization and identifying characteristics of modern, autonomous technique. He then isolates and elaborates on technique's inroads into economics, government, and man. The study of human techniques encompasses such "means" as time-and-motion studies, vocational guidance, propaganda, and certain medical practices. The discussion of these trends may contain his most perceptive (and arguable) observations.

Perkiss, Victor C. The Future of Technological Civilization. New York: Braziller, 1974.

Building on conclusions reached in his earlier work, the first part of this book is a virulent attack on "liberalism," which Perkiss states "made economic and technical growth the ultimate ends of human society." Contemporary developments--the discovery that resources are non-renewable, persistent social inequity, the threat of nuclear holocaust--have proven liberalism an inadequate philosophy. Currently available alternative ideologies--conservatism, anarchism, "antipolitics"--Perkiss labels "roads to nowhere." Instead, he offers "ecological humanism," a philosophy based on a consciously balanced relationship with nature and an analogous social order. The "new technological person" will see nature as an object of value and enjoy true "freedom"--an active and continuous participation in creating the future. Perkiss predicts an "unstructured, unorganized" movement toward reform that will result in a "convergent revolution to ecological humanism." Critics have labelled his outline a "vaguely grand non-scheme," but the author views his utopia as the "only alternative to the subversion of human civilization by alien forces."

Perkiss, Victor C. Technological Man: The Myth and the Reality. New York: George Braziller, 1969.

Technological change has made "human society into a seamless web" of interrelationships that necessitates new directions for mankind if the species is to meet the challenges of the arising culture. Perkiss is convinced that science and technique, by giving man "almost infinite power to change his world and to change himself," have led humanity to the verge of an "evolutionary breakthrough." The transfiguration, "technological man," will be responsive to and in control of the changes which have altered the previous civilization created by industrial man. This new man, as conceived by Perkiss, is not biologically nor psychologically altered, but is instead a distinct cultural type with a consciousness able to control all interacting elements in the social system. This power can be achieved through a

philosophy of naturalism, holism, and immanism which asserts that man is a part of a dynamic and interconnected universe shaped by what happens within the totality. Man must plan the development of the system he is part of if he is to be free and in control of his invented technologies. Technological man will create his own future with success depending upon his ability to use his head to recognize the potential effects of new elements and to mold them into what continued development requires. Substantial notes and bibliography accompany this thought-provoking but essentially vague work.

Florman, Samuel C. The Existential Pleasures of Engineering. New York: St. Martin's Press, 1975.

The interest that this book has generated can be credited in large part to its unusual authorship. Florman is a practicing engineer defending his profession and its work. He denies that engineers can be held responsible for damage that technology has done; they have not been entrusted with setting priorities nor have they been gifted with the hindsight necessary to pose and avert contemporary problems. The author's attack on the excesses of "anti-technologists," principally Ellul, Dubos, Mumford, and Koszak is spirited, if not always fair. He does not believe that technology is anonymous or undisciplined. He doubts that the increased leisure time that modern people enjoy and the artificial surroundings that they inhabit have been devastating to their spiritual health. But he is particularly sensitive to slurs on the intellectual and emotional rewards of engineering: "As seen by the anti-technologists, engineers and scientists are half-men whose analysis and manipulation of the world deprives them of the emotional experiences that are the essence of the good life." Not so, Florman protests--engineering work is deeply satisfying and even fun. For evidence, he seizes upon a largely unsorted collection of literary paeans to the machine and its manipulators. But even if the reader cannot visualize Camus' Sisyphus as an engineer, he must admit that the defense of the profession is persuasive and almost elegant.

Marcuse, Herbert. One-Dimensional Man. Boston: Beacon Press, 1964.

Marcuse is a Hegelian Marxist with a fundamentally pessimistic view of the social order and its future. In the past, he believes, social progress has depended on a tension between the "what is" and the "what might be." Through the provision of modern conveniences and ameliorated working conditions to the working classes, modern

technology has eased that tension, joining labor and higher classes into a "Warfare and Welfare" state just harmonious enough to resist qualitative changes. The "one-dimensional man" of this state has been robbed of inner freedom, depth, transcendence. He is aware only of practicalities. Nor can one look to the arts, social or natural sciences for spiritual leadership--all are contributing ideologically to the repressive social order. In toto, Marcuse feels, it is an empty world, in which the possibility of even a nuclear holocaust can be tacitly accepted.

Mesthene, Emanuel G. Technological Change: Its Impact on Man and Society. Cambridge: Harvard University Press, 1970.

This short, generally optimistic work overviews several major problem areas. The opening chapter takes issue with three "inadequate views" of technological change: that technology is 1) a blessing, 2) a curse, 3) not worthy of intense study, having had its greatest social impact during the Industrial Revolution. Mesthene, to the contrary, sees technology as a force that initiates social change through the generation of new opportunities and accompanying problems. The extent to which technological advances are adopted and affect society depends much on the social network itself; in sum, the interaction is extremely complex. In considering the effect of technology on values, Mesthene's conclusions are similar: technology, by providing new options for human action--nuclear war, genetic research--brings new ethical problems. In the end, the author believes, technological problems must be solved in the political arena. Thus far technology has tended to increase the pervasiveness and authority of government. Yet, Mesthene does not find evidence that the social complexity required by modern technology has created a "mass man." Throughout, the arguments are supported with findings from case studies; a sizable annotated bibliography supplements the volume.

Morison, Elting E. Men, Machines and Modern Times. Cambridge: MIT Press, 1966.

These artfully written essays were originally presented as lectures. For four of the papers, Morison uses case studies from his research in naval history and biography as documentation for larger generalizations on the nature of technological change. He first examines innovation and resistance to adoption; following are rather unfocused pieces on the nature of bureaucracy, computers and the man-machine relationship. A longer study on the diffusion of the Bessemer process in steel production is

followed by a final chapter of "proposals." Certainly, Morison's view of technology and its future is consistently optimistic; he sees society's current dilemma as one of organizing ideas and technologies to conform to human needs.

Muller, Herbert J. The Children of Frankenstein: a Primer on Modern Technology and Human Values. Bloomington: Indiana University Press, 1970.

Defining modern technology as the "elaborate development of standardized, efficient means to practical ends," Muller explores its economic, social and cultural consequences. He is concerned with what technology has done to as well as for people. Unlike Ellul and the anti-machine Luddites, Muller appreciates the material and cultural goods which have resulted from technology and have contributed to the "good life." But many of man's innate drives, such as natural curiosity, the aesthetic sense, creative activity, and the desire for self-realization have been stifled by the machine culture and widely ignored by behavioural scientists because of the difficulty of approaching such intangibles by refined methodologies. The author believes it is "technically possible" for man to control the Frankenstein Monster, and to "employ it for saner, more civilized purposes than he does right now." In order to provide a perspective on the problems to be confronted, Muller presents an historical survey of the importance of technology in man's history, then he considers the effects of the monster on various aspects of human life including science, government, business, the city, mass media, people. Finally, he looks at the year 2000. Muller's style is delightful and is sparked by a fine wit as evidenced in his observation that we need not worry about cannibalism anymore, "we have so much DDT in us that we are all inedible."

Roszak, Theodore. Where the Wasteland Ends: Politics and Transcendence in Post-Industrial Society. New York: Doubleday, 1973.

Passages aptly drawn from the Apocalypse open this diffuse, highly personal, peculiarly optimistic book. Roszak reveals himself to be more at odds with technology than perhaps any other leading scholar. He is bitter about the artificial environment that technology has generated. He finds no corner left untouched: even primitive and wilderness areas are being annexed to the technological world, transformed into no more than Disney-frontier playgrounds. Technology itself is effete, "musclebound," now reduced to undoing earlier damage, though still capable of inflicting new disasters. Roszak

is most concerned about technology's effect on the human spirit. Because the workings of technology are unintelligible to most people, they feel a deep helplessness, a loss of control over their destinies. Mind control, terror-therapy, and brain transplants are among Roszak's frightening examples of crimes against the spirit that are now technologically feasible. More to be feared, he feels, is the gradual impoverishment of life, the loss of rich symbolism, mystery and poetry that are incongruent with the reductionist rationalism required of a technological society. It is in viewing such contemporary social developments as religious revivals and back-to-the-land movements that Roszak takes heart, and in which he feels are the genesis of a revival of mystery and myth, marking the end of the wasteland.

Schumacher, E.F. Small is Beautiful: Economics as if People Mattered. New York: Harper and Row, 1973.

Our "idolatry of giantism" and greed have "delivered us over into the power of the machine." Schumacher contends that with imagination technology can be redirected so that it serves man and supports his human needs rather than destroys him. From technology we need methods and equipment which are "cheap enough so that they are accessible to everyone, suitable for small-scale application, and compatible with man's need for creativity." This would lead to "production by the masses" in contrast to "mass production." Termed intermediate technology, it makes "use of the best of modern knowledge and experience, is conducive to decentralization, compatible with the laws of ecology, gentle in its use of scarce resources, and designed to serve the human person instead of making him the servant of machines." It is appropriate to the human animal and the environment in which he lives. In the chapter "Buddhist Economics," Schumacher sees work not as an "inhuman chore" to be abolished by automation, but rather something that is needed for the good of man's body and soul. Without it there is no self-reliance or self-esteem. The base of economic planning should be full employment rather than the production of the most with the least capital outlay. Super-technology breeds unemployment and for those with jobs "creative, useful work with hands and brains" is replaced by fragmented, repetitive labor which denies thought. A decrease in automation would lead to more meaningful work and also less use of finite natural resources. That the effects of the depletion of fossil fuels remain unmentionable, although not unacknowledged, is caused by the attitude that "something will turn up." This is Micawberian childishness. Schumacher sees man's key to the future to be the replacement of "getting and spending" with a reduction of needs, the development of labor-intensive manufactures, and a concern for "health, beauty, and permanence."

Seligman, Ben B. Most Notorious Victory: Man in an Age of Automation. New York: The Free Press, 1966.

The implications of automation's control of man's fate are economic, social, psychological, and philosophical. Seligman considers the inability of the economic mind to visualize the effects of technology on essential human qualities. Modern technology's stress on process--how a thing is made--has largely eliminated inquiry into human ends and purposes. This highly documented synthesis of source material, an essential basis for subsequent scholarship, focuses on the impact of the computer in modern life. An internal drive, quite independent of man, has enabled the new technology to create a society in which control of the many is in the hands of a few specialists. The over-value of the calculable and manipulable has removed freedom from man's construction of work and leisure. Meaningless, debased toil is complemented by "play" that has been forced "into a commercial mold." Because leisure "is the way to spend money," a codified set of sold programs stifles man's ability as a begetter of culture. Seligman's weakness is that he makes little attempt to present either suggestions for the control of technical change or guidelines for the measurement of the human cost of advancing technology.

Terkel, Studs. Working. People Talk About What They Do All Day and How They Feel About What They Do. New York: Pantheon Books, 1974.

Terkel's ability to encourage people to take emotional risks and expose the ambivalence in their psyches is precious. These interviews with workers from garbage man and parking jockey to film critic and conglomerate president create one overpowering impression: man, taking his identity from the work he does, must achieve a sense of dignity. A steelworker admits that "Sometimes . . . when I make something, I put a little dent in it. I like to do something to make it really unique." The heavy equipment operator says "It's food for your soul that you know you did it good." Perhaps the guy who parks cars is the most beautiful: "I used to be a wizard, I used to really roll. I could spin a car with one hand and never miss a hole. . . . I could drive a car like a baby . . . I was one of the best . . . They'd say, 'Lover, you never miss.'" Reading these interviews leads to the disturbing realization that it is this need for creativity that begets self-deception and love of slavery. Workers trapped on assembly lines and in jobs that demand total attention every second, thus eliminating personal expression, are broken, frustrated, tense victims of paranoia. But even they constantly ask difficult questions about the "meaning" of their jobs. So many express the despair of the Ford stock chaser: "I felt

I was just a robot. You push a button and you go this way. You become a mechanical nut." The union president looks at the monster replacing men: "A unimate is a welding robot. It looks like a praying mantis . . . . They never tire, they never sweat, they never complain, they never miss work. Of course, they don't buy cars." Dreams of something better are never abandoned. Those resigned to their inability to break free focus their hope on their children: "I want my kid to be an effete snob . . . I want my kid to look at me and say, 'Dad, you're a nice guy, but you're a fuckin' dummy.'" A woman sums it up: "Jobs are not big enough for people."

Toffler, Alvin. Future Shock. New York: Random House, 1970.

Toffler's thesis is that change--social and technological--is accelerating at such a rate that human beings can no longer adapt. Like native peoples undergoing "culture shock," we will undergo "future shock." The first portion of the book documents at length the more spectacular innovations in goods, services, and lifestyles of recent years. Speculations on future developments abound: what 24-hour light would do to Sweden's brooding culture; what the social impact of robot airline hostesses or simulated adventures might be. Evidence offered for contemporary symptoms of "future shock" is a mixed-bag of research on stress and illness, "information overload," sensual bombardment studies, current social trends toward fragmentation of the family. His "strategy for survival" through this impending crisis of nerves is "de-stimulation"--the creation of "personal stability zones and societally planned change." Despite the author's fervor, "future shock" never gels as a fearful identifiable condition with recognizable symptoms and recorded "cases." It is difficult to shake most people's faith in man's infinite adaptability, and Toffler doesn't really succeed.

Winner, Langdon. Autonomous Technology: Technics-Out-Of-Control as a Theme in Political Thought. Cambridge: MIT Press, 1977.

The idea of "autonomous technology" grew through the nineteenth and twentieth centuries as writers began to question some widely held traditional assumptions about the nature of technology. Winner lists three of those assumptions: that people know and understand things that they make; that they can control things that they create; and that technology is only a means to a larger end. Refutation of the assumptions requires a long look at the way modern technology progresses. The notion of a direct, sequential "march of progress" is a myth. Rather, the author holds, technological change is a "variety of

currents of innovation moving in a number of directions toward highly uncertain destinations." In the absence of a coherent, full picture, contemporary technology cannot be fully comprehended, nor its future predicted; thus it cannot be controlled. Ironically, it is exactly that element of unpredictability that has yielded both great technological successes and fiascoes. The complex, rational nature of the technological effort requires a task-oriented restructuring of the work environment and of personnel. Restructuring may extend beyond the confines of the technological system to the political and social arenas. It is this manipulative process, and its description by contemporary social theorists, that interest Winner as a political scientist: "Technological politics . . . . encompasses the whole of technology's capacity to transform, order and adapt animate and inanimate objects to accord with the purely technical structures and process." The massive, interdependent, autonomous systems required to perform modern technology have become divorced from the goals of society at large, their ultimate purpose self-preservation and stability. Citizens at large have been shielded or barred from exposure to technical terms, concepts and organizations to the extent that there can be no meaningful communication. Winner contends that the technological system has thus become not only autonomous but also isolated: "Technology is now a kind of conduit such that no matter what aims or purposes one decides to put in, a particular kind of product inevitably comes out."

9. PHILOSOPHY AND ETHICS

Adams, Henry. The Education of Henry Adams. 1907. Boston: Houghton Mifflin, 1973.

The transformation of life by technology permeates Adams' consciousness. It was his belief that "the whole social, political, and economic problem is the resultant of the mechanical development of power." The shift in power from Nature and man to the machine is effectively realized in the chapter "The Dynamo and the Virgin," an account of the author's visit to the Gallery of Machines at the Paris Exhibition of 1900. Previous to the Industrial Revolution, the most powerful force in the Western world was the female goddess, whether in the form of Diana or the Virgin. She possessed the energies of sex and reproduction. Suddenly, however, the mighty dynamo erupts with a totally new artificial force which threatens to destroy the creative impulse of the Virgin. As Leo Marx states, on one side Adams "lines up heaven, beauty, religion, and reproduction; on the other: hell, utility, science, and production." This work offers a sensitive, contemporary view of a world pushed into violent flux by technology. Adams wrote to a friend: "Out of a medieval, primitive, crawling infant of 1838, to find oneself a howling, steaming, Marconiing, radiumating, automobiling maniac of 1904 exceeds belief."

Arendt, Hannah. The Human Condition. 1956. Chicago: University of Chicago Press, 1969.

Arendt's philosophy of technology is contained within a larger framework of thought on the "vita activa," which consists of three fundamental human activities: labor, work and action. "Labor" in Arendt's sense is the vital functioning of the body, in contrast to work, which provides an "artificial world of things, distinctly different from all natural surroundings." What characterizes work itself, she observes, is the rhythm it imposes on and demands of the laborer's body. This rhythm is mechanized easily, but with the result that the laborer must "adjust the natural rhythm of his body to . . . mechanical movement." On the nature of the man-machine relationship, Arendt is characteristically subtle: "if the human condition consists in man's being a conditional being for whom everything, given or man-made, immediately becomes a condition of his further existence, then man adjusted himself to an environment of machines the moment he created them." But she concludes that the machine is powerless to effect "the most important task of artifice--offering mortals a more permanent and stable dwelling place than themselves." A scholarly, basically pessimistic work.

Hamilton, Michael, ed. The New Genetics and the Future of Man. Grand Rapids, Mich.: Eerdmans, 1972.

This volume contains the papers of a symposium organized by the Washington Cathedral, of which the author is Canon. The documented essays contributed by theologians, lawyers, and philosophers form a well-rounded attempt at assessing the legal and ethical aspects of developing areas of genetics. The papers address such potential technical developments as cloning, prenatal adoption and transplantation, and related extensions into "genetic engineering" and "genetic therapy." Thoughtfully presented.

Mitcham, Carl and Robert Mackey, eds. Philosophy and Technology: Readings in the Philosophical Problems of Technology. New York: Knopf, 1970.

While a number of anthologies are concerned with the impact of technology on human values, this lengthy and scholarly representation of current thinking on philosophy and technology is perhaps the most impressive. The first part, "Conceptual Issues," considers technology as an epistemological problem, a curious feature of human nature, a driving force in modern thought. Ethical and political critiques of technology comprise a second part. C.S. Lewis, for one, fears that in conquering nature man will lose his humanity and his awe and reverence for physical reality; C.B. MacPherson fears the effects of an inundation of superfluous goods on a victimized, satiated society. The collection of religious critiques reveals the contradictory meanings of Christianity for technological man. Eric Gill laments the passing of the Christian virtue of poverty; Lynn White singles out Christianity's man-centeredness as one of the "historical roots of our ecological crisis." Existentialist critiques by Junger and Ortega y Gasset and a selection of metaphysical studies conclude the volume. A fine selective bibliography is appended.

Pirsig, Robert M. Zen and the Art of Motorcycle Maintenance: an Inquiry into Values. New York: Morrow, 1974.

Intended neither as a reliable motorcycle manual nor as a coherent guide to Zen Buddhism, this honest, mostly factual account records the physical and intellectual events of a motorcycle trip through the West. While observing the minutiae of the landscape, the writer reviews his relationships with friends, son and cycle. He finds spiritual peace in the patient, methodical tuning of the cycle, and takes intellectual delight in solving imaginatively and logically the finite mechanical problems the cycle presents. His harmonious tie to technology,

symbolized by the cycle, is contrasted to the suspicious incomprehension of mechanical activities exhibited by his friends. In musing over abstract philosophical problems, such as the nature of quality or knowledge, the writer experiences less tranquility. Persistent self-questioning has once led to a mental breakdown, and he must confront the ghost of an earlier self he now calls Phaedrus as he visits old friends and haunts. As the trip progresses, he learns much about his strained relationship with his child, and yet it continues to deteriorate. The narrative can be boresomely pedagogical or wildly brilliant. One nevertheless pleased reviewer aptly summed up the work as an "ungainly piece of do-it-yourself American Gothic."

Restak, Richard M. Pre-Meditated Man: Bioethics and the Control of Future Human Life. New York: Viking Press, 1975.

Questions regarding the human consequences of biomedical technology involve power: in what direction are advances headed and who is in charge? Restak contends that the control and regulation of the field must ultimately rest with nonscientists and "non-experts." The social nature of biotechnics must be realized. Psychosurgery involves the appropriateness of behavior-control technology in a free society. Genetic engineering will have a profound effect on our traditional belief in genetic identity. What price are we willing to pay for the perfect baby? The myths and misinformation surrounding sickle cell anemia and XYY chromosome configuration reveal how genetic science has been used in service of racial prejudice and exploitation. These issues must be considered in relation to a broad-based, participatory bioethics that is, above all, humanistic.

Vaux, Kenneth. Biomedical Ethics: Morality for the New Medicine. New York: Harper and Row, 1974.

A new discipline is necessary to discern the patterns of ethical decision making and planning in the interplay of technological advances and human nature which effects choices in biomedicine. Because man as machine is the "prevailing perception of our time," it is difficult to understand the dynamics of moral decisions in medicine. Vaux's contemporary frame of reference evolves from a synthesis of traditional humanistic ethical traditions with consequential insight, that is, the ability to predict what will happen before something is done. This is achieved from the joining of moral conscience with technical know-how. Biomedical topics are explored in which technology has necessitated imperative decisions and planning, i.e., generation, rebuilding, controlling, and immortalizing man.

Walters, LeRoy, ed. Bibliography of Bioethics. Center for Bioethics, Kennedy Institute, Georgetown University and Gale Research Co. Annual.

Published in 1975, the initial issue of this bibliography attempts to identify the central issues in bioethics and provide comprehensive, cross-disciplinary coverage of English-language materials relevant to value questions in the biomedical field. Including books, articles, court decisions, legislation, films, and audio cassettes, the bibliography is arranged under the following topics: history of medical ethics, physician-patient relationship, contraception, abortion, reproductive technologies, genetic intervention, mental health therapies, human experimentation, artificial and transplanted organs, death and dying, international dimensions of biology and medicine. The monitoring of 38 research tools results in exceptional interdisciplinary coverage. Services consulted include: Biological Abstracts, Index Medicus, Index to Legal Periodicals, Modern Federal Practice Digest, Psychological Abstracts, Medical Socioeconomic Research Sources, Public Affairs Information Service, Reporter on Human Reproduction and the Law.

## 10. CASE STUDIES

Dettlback, Cynthia. In the Driver's Seat: the Automobile in American Literature and Popular Culture. Westport, Conn.: Greenwood Press, 1976.

American culture, seen here as a particular union of "space, romance, and technology," is concretized in the automobile. The car is an ambivalent metaphor of the American dream/nightmare experience. Although our romantic imagination has been led to believe in a democratization of heroism--all it takes is "the key to the car," American artists reveal that dreams of innocence, freedom, success, and possession end in nightmares of experience, constraint, failure, and of being possessed. From Faulkner, Hawkes, and Updike to Woody Guthrie, Tom Wolfe, Jason Selby, and American Graffiti, all motorized quests end in the junkyard. An initial adolescent worship of the machine leads to an experienced view of the car as destroyer of dreams and symbol of a technological future that does not work.

Peaver, Douglas D. and Edward J. Gallagher, eds. Humanistic Perspectives on the City: a Select Bibliography. Monticello, Ill.: Council of Planning Librarians Exchange Bibliography #934, 1975.

Several faculty members involved in a "Life and Work Habitat" seminar at Lehigh University contributed to this generously annotated bibliography which provides basic readings for an interdisciplinary approach to the "complex problems posed by the city." The subject is seen from the viewpoints of various humanities disciplines: American history, American literature, science fiction, fine arts, economics, classics, philosophy, religion, social relations, urban studies, visual media, work and leisure.

Kidwell, Claudie B. and Margaret C. Christman. Suiting Everyone: the Democratization of Clothing in America. Washington, D.C.: Smithsonian Institution Press, 1974. Available from U.S. Government Printing Office. Stock number: 4701-00119.

As a supplement to the exhibition at the Smithsonian Institution, textual commentary and additional illustrative material are presented which document the social and technical forces that created the "Clothing Revolution" in America. The "spirit of egalitarianism" evident in members of the aspiring middle class of nineteenth-century America, who considered themselves as good as anyone else and wanted the clothing to prove it, was

responded to by the emergence of skilled craftsmanship in textile technology. The result was "ready-made clothing of a quality which made it possible for the lowest of men to look not unlike the highest of men." The authors consider diverse elements, in addition to advances in machinery, which spurred the progress of the industry: immigration brought people with skills and retailing talents as well as the workers who "manned" the industry, and the springing up of department stores and mail order houses made mass distribution possible. The abundance of excellent illustrations and photographs focus on machinery, advertisements, clothing, and department stores.

Mailer, Norman. Of a Fire on the Moon. Boston: Little, Brown and Co., 1970.

Despite a four-year education in aeronautical engineering, Mailer, with self-indulgent egomania, bemoans his inability to relate to the Apollo 11 moon mission. NASA's Manned Spacecraft Center, and the Vehicle Assembly Building, "first cathedral of the Age of Technology," are devoid of romance--the walls are gray and windowless, the astronauts are small-town cliches who avoid an heroic posture, the technicians and engineers are "cogs in the machine," and everything is made of odorless plastic. But Mailer plays Merlin. He succeeds in restoring "magic, psyche, and the spirits of the underworld to the spookiest venture in history, a landing on the moon." A "psychology of machines" is essential because there are spirits in the technological appliances which give them a "mind of their own, harboring waywardness, self-will, and even magic." (Indeed, today we need only give thought to the contrary computer on the Saturn-Jupiter by-pass craft.) Mailer presents the hypothesis that the colossal moon venture could prove to be an exploration, via technology, to discover the passions and instincts which have made man worship the machine throughout his history. Finally, a moon rock becomes a symbol of romance: "she was gray, . . . gray as a dark cinder. . . but he liked the moon rock, and thought . . . that she liked him. . . there was something young about her, tender as the smell of the cleanest hay, it was like the subtle lift of love which comes up from the cradle of the new born . . . so he had his sign, sentimental beyond measure . . . ."

Trachtenberg, Alan. Brooklyn Bridge: Fact and Symbol.  
New York: Oxford University Press, 1965.

From the time of its inception, the Brooklyn Bridge has been charged with symbolic meaning. Trachtenberg's purpose is to examine the bridge as artifact and as symbol. In the early nineteenth century, it was drawn by an artist as a rainbow linking the islands; a pragmatist labelled such a bridge "chimerical, from the magnitude of design." It is fitting that a philosopher who also was an engineer (with a flourishing wire rope business), John Roebling, undertook the project. Yet the clash of harsh physical and commercial realities with the ideals of the conceivers did not disappear. Artistic responses to the bridge ranged from minute aesthetic judgments (displeasure with the rather awkward combination of masonry and steel) to identification of the bridge with the entire machine-world. Henry James called it a "chilly monster;" Hart Crane revelled in it. In 1883, the opening year, an anonymous wag was straightforward: "Babylon has her hanging gardens, Egypt her pyramids, Athens her acropolis, Brooklyn her bridge."

White, Lynn, Jr. Medieval Technology and Social Change.  
New York: Oxford University Press, 1962.

White's presentation of three case studies of technology and social change during the Middle Ages is considered by many to be a "classic" in the history of technology. The first discusses the development of the stirrup and its role in the transformation of the feudal knight into a swift, fierce and "chivalrous" fighting machine as well as the larger societal consequences of that transformation. The second study gives credit to the inventive medieval peasant as it focuses on what White terms a ninth-century "revolution" in agriculture that moved the focus of subsequent history north. The last focuses on the creation and discovery of new power sources and machines seminal to modern developments. White's evidence is drawn widely and well not only from manuscripts and medievalists but also from archaeology, art, and other expressions of society as a whole. The lengthy "notes" section is a treasure trove. Throughout, White frequently reminds the reader of the importance of the diffusion of innovations and goods from the East during the period.

Wiener, Norbert. The Human Use of Human Beings. 1950.  
New York: Avon Books, 1969.

This is the layman's version of Wiener's classic, Cybernetics. Cybernetics, in the author's original sense, may be defined as a comprehensive study of messages, encompassing computers and automata, and the human mental and nervous apparatus. It is the author's belief that communication, whether transmitted through man or machine, will be increasingly important in society's future development. At some length, Wiener discusses the concepts of input, output, and feedback in relation to nervous system and computer. He concludes that if one could build a machine with a mechanical structure identical to that of human physiology, such a machine would in fact possess human intellectual capacities. The last half of the book, the "society" portion, is now rather outdated. Wiener characterizes and compares the role of communication in law and in the intellectual world. Identifying automation as the keynote of a second industrial revolution, he predicts the decentralization of industry and the disappearance of the contemporary organization of labor. Closing chapters outline then existent "communications machines" and encourage their thoughtful development.

## 11. JOURNALS

American Quarterly. American Studies Association.  
Quarterly. 1949-

With the aim of providing direction for studies in the culture of the United States, articles focus on history, literature, the effects of science and technology, mass culture, politics, art in American life. Book reviews and notices of dissertations in progress are included. The Committee on Bibliography publishes annually an annotated interdisciplinary bibliography of current articles in American Studies. Topics covered include science and technology, sociology, psychology, mass culture, political science, literature, art, teaching of American Studies.

American Scholar; a quarterly for the independent thinker.  
United Chapters of Phi Beta Kappa. Quarterly. 1932-

A review of social issues and the arts with frequent attention to the science-humanities debate. Contributors include Jacques Barzun, Kenneth Keniston, Alfred Kazin, Daniel Bell, Kenneth Clark, William Styron, Lillian Hellman. Rene Dubos, in his regular column "The Despairing Optimist," discusses ecology, the art of living, and human foibles. Poetry and book reviews accompany articles.

American Scientist. Sigma Xi, and the Scientific Research Society of America. Bimonthly. 1913-

A general science journal (some emphasis on the earth sciences). Generally contains several articles per issue discussing social implications of specific technological developments (especially environmental issues). Numerous book reviews; list of books received.

Annals of Science. Taylor and Francis, Ltd., London.  
Quarterly. 1936-

Subtitled "an international review of science and technology from the thirteenth century." While the main articles stay fairly closely within the history of science, the "essay reviews" and book reviews also touch upon technological and social history.

Art in America. Art in America, Inc. Bimonthly. 1913-

Primarily concerned with contemporary visual arts, polished articles by established critics consider the links between art and the society reflected therein. Contributors, including Douglas Davis, Harold Rosenberg, and Barbara Rose often discuss the use of new technologies by artists. Includes reviews of exhibitions and new books. The quality of reproductions and writing make this the best journal for 20th-century art.

The Bulletin of the Atomic Scientists: a magazine of science and public affairs. Educational Foundation for Nuclear Science. Monthly. 1945-

Offering a bridge between the sciences, humanities, and politics, primary interest is on the relationship of the growth of science and technology to environment, institutions, and culture. Articles written by experts, most of whom reveal a concern for the technology/civilization interface, are decidedly liberal. Letters, commentary, and book reviews provide an effective information exchange.

Clio: an interdisciplinary journal of literature, history and the philosophy of history. University of Wisconsin-Parkside. Tri-annual. 1971-

Integrating history, literature, philosophy, and religion, articles reflect the journal's interest in the role of history in literature, the literary qualities of historical works, and the philosophy of such cross-disciplinary study. Lengthy book reviews, notes on new books, scholarly communications, and brief remarks on current research are featured. Clio publishes yearly an annotated bibliography titled, "Relations of Literature and Science," prepared by the Bibliography Committee of MLA General Topics VII.

Daedalus. American Academy of Arts and Sciences. Quarterly. 1955-

Each book-length issue is devoted to one social, political or literary topic. Contributions are from leading scholars; thus each number forms a major review of lasting value. Recent pertinent issues have included: "Doing Better and Feeling Worse: Health in the United States" (Winter 1977); "Science and its Public: The Changing Relationship" (Summer 1974).

Environment. Scientists' Institute for Public Information.  
Bimonthly. 1958-

Well-documented, non-faddist articles on many areas of environmental and consumer concern, from air pollution and nuclear power dangers to pesticides and plutonium. Some of the articles are by experts; "Spectrum" provides news of the month; "Overview" is a commentary on current developments. More for the activist than the detached observer.

Extrapolation: a journal of science fiction and fantasy.  
Department of English, College of Wooster. 2 issues/yr.  
1959-

Sponsored jointly by the MLA Seminar on Science Fiction and the Science Fiction Research Association, Extrapolation publishes articles by academics of interest to literary scholars and historians of science. Strengths include history of SF, bibliography, and criticism. Publishes an annual annotated checklist, "The Year's Scholarship in Science Fiction and Fantasy."

Futures: the journal of forecasting and planning. IPC  
Science and Technology Press, U.K.; and Institute for  
the Future, U.S. Bimonthly. 1968-

Articles present predictive views of the future, analyses of specific aspects of life to come, such as work, food, mental health, cities, as well as methodological studies of futures research. Notices of coming conferences and meetings, overviews of meetings held, and book reviews are provided.

Hastings Center Report. Institute of Society, Ethics and  
the Life Sciences. Bimonthly. 1971-

Devoted entirely to bioethics, articles explore the social, ethical, and legal questions implicit in the technologies of human experimentation, genetic engineering, contraception, abortion, organ transplantation, prolongation of life. In line with the Institute's goals, that is, the advancement of research into the human impact of biological technology, and the stimulation of the inclusion of ethical inquiry in university curricula, the Report presents brief notices of new developments, essays and articles, case studies, and a calendar of events. Each issue contains an annotated guide to recent articles, books, and reports in the field.

The Humanist: a journal of humanist and ethical concern.  
American Humanist Association and the American Ethical  
Union. Bimonthly. 1941-

In an attempt to fuse philosophical discussions and practical applications of humanistic viewpoints to contemporary social problems, contributors in each issue examine ethical aspects of a central topic. Issues ranging from extraterrestrial intelligence, anti-science, and ecology to secular humanism, humanistic psychology, and the pursuit of happiness have been considered recently. Includes poetry along with film and book reviews.

Humanities Perspectives on Technology: curriculum newsletter of the Lehigh University HPT Program. Lehigh University. Bimonthly. 1977-

Designed to promote and support the development of courses and programs which relate technology, society, and human values, the newsletter serves as a forum for the exchange of ideas by educators working in this interdisciplinary field. Articles describe actual courses, theoretical curriculum ideas, and techniques for instituting relevant courses or programs. Includes detailed reviews of books, films and a-v materials, as well as an annotated guide to new publications (books, articles, government pubs.). An on-campus newsletter, HPT News, which publishes brief interdisciplinary articles, poetry, reviews of books and a-v materials, is also available to outside researchers and educators.

Impact of Science on Society. UNESCO, Paris. Quarterly. 1950-

International coverage and authorship. Each issue devoted to a specific topic (recent issues have included "Science and Common Sense;" "Youth Confronts Science;" "Science and War"). Articles are fairly short and written for the general reader.

Isis. Johns Hopkins University Press. Quarterly. 1913-

The official journal of the History of Science Society, this is an international review devoted to the history of science and its cultural influences. Occasional treatment of technological topics. Essays, shorter studies, and numerous book reviews. A major feature is the annual "Critical Bibliography."

Journal of Popular Culture. Popular Culture Association and Bowling Green State University. Quarterly. 1967-

Contemporary mass culture is portrayed from multiple viewpoints. Articles cover popular art and music, science fiction, Black culture, literature, automobiles, sports, new journalism, electric media, technology's effect on life styles. Articles have research value as well as being exceedingly entertaining. Issues contain 4-6 book reviews.

Leonardo; international journal of the contemporary artist. Pergamon Press. Quarterly. 1968-

Concerned with contemporary visual and plastic arts, emphasis is given to articles discussing the interrelationships of scientific and technical achievements within the arts, the use of new materials and techniques resulting from advances in technology, and the effect of social forces on creativity. Reports on art/science/technology conferences, reviews of interdisciplinary books, and "International Science-Art News" are additional features.

Nature. Macmillan Journals, Ltd., London. Weekly. 1869-

Science news, short essays, brief research reports provide international coverage. Useful for comment on global social and political issues related to science and technology. Includes book reviews, books received list.

New Scientist. 128 Long Acre, London. Weekly. 1956-

British weekly science magazine for laymen with a lively style and diversified content. Balanced coverage of scientific and technical fields; much space devoted to brief articles and commentary on social and economic impact of technical advances. Witty and incisive book reviews.

Newcomen Society for the Study of the History of Engineering and Technology. Transactions. Annual. 1922-

The Society's object is to "support and encourage study and research in the history of science and technology and the preservation of records both technical and biographical." British authorship and emphasis; studies tend to be highly specialized and not generally oriented toward discovering social impacts of technological developments.

Newsletter on Science, Technology and Human Values. Harvard University. Program on Science, Technology and Public Policy. Quarterly. 1971-

Sponsored by funds from the National Science Foundation and the National Endowment for the Humanities, the Newsletter is the "central switchboard and matchmaker" for the invisible college of individuals concerned with research and teaching in the interdisciplinary field of technology, science, values, and society. It is at present the major mechanism for sharing relevant information and resources. The "News Items" section contains announcements of government actions, activities of organizations and programs, reports of research, notifications of conferences and fellowship opportunities. Recent articles, books, and reports are listed and annotated in the "General Bibliography" section. Scholarly articles and special bibliographies on specific topics are also featured. The editorial board reflects the cross-disciplinary interest with specialists in history, philosophy, literature, sociology, political science, bioethics, the natural sciences, and engineering.

Science. American Association for the Advancement of Science, Washington. Weekly. 1880-

Authoritative articles, reports, book reviews and news for specialist and layman. Some emphasis on life sciences. Recently has contained much on health and resources.

Science Fiction Studies. R.D. Mullen and Darko Suvin, Department of English, Indiana State University. 3 issues/yr. 1973-

With editors and consultants including Le Guin, Aldiss, Northrop Frye, and Hillegas, articles and bibliographies reflect interest in studies of science fiction and utopian fiction excluding supernatural and fantasy literature. Correspondence, reports of meetings, book reviews make the journal a forum for SF researchers. Issues are often dedicated to special topics and authors.

STPP News: an interdisciplinary newsletter on science, technology, public policy and society. Political Science Department, Purdue University. Monthly. 1974-

Seeks to be an exchange medium for researchers and educators considering the effects of technology on society. Publishes articles; many reviews of books, films, a-v materials, government publications; "Vertical File" section provides an alerting service to contents of current journals.

Scientific American. Scientific America Co., Inc. Monthly.  
1845-

Intended for the intelligent lay reader. Balanced treatment is accorded topics in the life and physical sciences, technology, and to some extent, the social sciences. Much appears on technology/society relationships. Illustrations and book reviews. An aside: for those interested in the development of nineteenth century American technology, there may be no better source (certainly no more lavishly illustrated one) than the last century's volumes of this journal.

Social Studies of Science. Sage Publications. Quarterly.

Formerly Science Studies. An interdisciplinary and international journal devoted to the publication of research on modern science's concepts and consequences. Includes contributions from distinguished scholars in the fields of history, the sciences, and the social sciences.

Technological Forecasting and Social Change: an international journal. American Elsevier. Bimonthly. 1969-

Methodological studies concerned with the measurement of the impact of technology on society are the major focus of this journal. Occasional articles on values, science policy, and technology's effects on mankind also appear. Books on planning, Futures forecasting, interdisciplinary approaches to technology are reviewed.

Technology and Culture. University of Chicago Press.  
Quarterly. 1960-

Published for the Society for the History of Technology, a body concerned "not only with the history of technical devices and processes but also with the relationship of technology to the sciences, politics, social change, arts, humanities, economics. The varied long articles, research notes and fine book reviews reflect these many concerns. Annual bibliography.

Technology Review. Massachusetts Institute of Technology.  
Monthly. 1899-

"Departments" section reviews current scientific and technical advances, brief editorials on specific technological effects on society and environments.

There are special reports and book reviews. Each issue also contains a number of articles geared to the general reader treating technical impacts on art, education and industry. Unassuming format, solid content.

Zygon: journal of religion and science. University of Chicago. Institute on Religion in an Age of Science and The Center for Advanced Study in Religion and Science. Quarterly. 1966-

While the emphasis is on an integration of religion with science, articles dealing with an ethical approach to the social effects of technology also often appear. Evolution, human values, bioethics, ethics and ecology, complementarity in scientific and religious thinking are topics of specific interest.